

**TECHNICAL IMPRACTICABILITY ZONE DELINEATION
WORK PLAN**

**SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS**

Prepared for:

Beazer East, Inc.

Prepared by:

Key Environmental, Inc.
200 Third Avenue
Carnegie, Pennsylvania 15106

MAY 2013

TABLE OF CONTENTS

LIST OF FIGURES	ii
LIST OF ATTACHMENTS	ii
1.0 INTRODUCTION.....	1-1
1.1 PROJECT OBJECTIVES.....	1-1
2.0 TI ZONE DELINEATION SCOPE OF WORK.....	2-1
2.1 EXISTING MONITORING WELL SEARCH, INSPECTION AND GAUGING ACTIVITIES	2-1
2.2 INSTALLATION AND SAMPLING OF TEMPORARY MONITORING WELLS	2-2
2.2.1 Soil Borings and Temporary Well Construction.....	2-2
2.2.2 Groundwater Sample Collection and Analysis	2-4
2.2.3 Temporary Monitoring Well Abandonment	2-5
2.2.4 Survey.....	2-5
2.3 EXISTING MONITORING WELL AND PIEZOMETER SAMPLING	2-5
2.4 QUALITY ASSURANCE/QUALITY CONTROL.....	2-7
3.0 INVESTIGATION DERIVED WASTE	3-1
4.0 SCHEDULE AND DELIVERABLES.....	4-1

LIST OF FIGURES

- 1 Site Location Map
- 2 Proposed Soil Boring/Temporary Well Locations
- 3 Proposed Groundwater Sampling Locations
- 4 Proposed Project Schedule

LIST OF ATTACHMENTS

- A Health and Safety Plan
- B Field Information Forms
- C Low Flow (Minimal Drawdown) Groundwater Sampling Procedures – Standard Operating Procedure 36
- D Quality Assurance Project Plan

1.0 INTRODUCTION

This document was prepared on behalf of Beazer East, Inc. (Beazer) and presents a Work Plan to collect additional and current data to support the Technical Impracticability (TI) Zone delineation of the horizontal and vertical extent of constituents of interest (COI) in the shallow and intermediate groundwater-bearing zones at the South Cavalcade Superfund Site located in Houston Texas (Figure 1). At a meeting among representatives of Beazer, U.S. Environmental Protection Agency (EPA) and the Texas Commission on Environmental Quality (TCEQ) at EPA Region VI offices in Dallas, Texas on April 9, 2013. EPA informed Beazer that Region VI and EPA Headquarters personnel have determined that an amendment to the Record of Decision (ROD) for the Site, which incorporates a TI (TI) Waiver for groundwater remedial goals is appropriate. EPA stated that current data regarding the nature and extent of COIs in groundwater are needed to support the definition of the boundaries of the TI Zones. Beazer has agreed to conduct the site characterization activities to acquire current data to support the definition of the TI Zones.

The scope of the investigation proposed herein was developed through collaborative efforts of representatives of Beazer, EPA and TCEQ. The development of the scope of the investigation was initiated during the aforementioned April 9, 2013 meeting and was finalized during two subsequent conference calls among the parties on April 10, 2013 and April 19, 2013. During the April 19, 2013 conference call, EPA requested that Beazer prepare a brief Work Plan describing the scope of the investigation and the methodologies to be utilized for its implementation. This Work Plan was prepared in response to the EPA request. The specific objectives of the planned activities are outlined in the following subsection.

1.1 PROJECT OBJECTIVES

The primary purpose of the proposed investigation is to provide additional and current data to support the definition of the limits of the TI Zones. The data acquired through implementation of this Work Plan will also be used in support of the preparation of the Proposed Plan and ROD Amendment, and in the development of a proposed future groundwater monitoring program. The approach to attaining the stated objectives involve the development of a comprehensive “snapshot” of the current nature and extent of COIs in groundwater. The snapshot of current conditions will be obtained through the installation and sampling of several temporary monitoring wells, located predominantly along inferred preliminary TI Zone boundaries, concurrent with the sampling of existing monitoring wells and piezometers. This is the same investigation approach that was successfully employed for the 2005 Supplemental Groundwater Characterization effort which was designed to investigate the potential presence of preferential contaminant migration pathways at the Site.

A report of findings (Technical Impracticability Zone Delineation Report) will be prepared to document the results of the investigation. The report will include proposed TI Zone boundaries and a proposed future groundwater monitoring program.

2.0 TI ZONE DELINEATION SCOPE OF WORK

The following section presents the scope of work for the investigative activities and methodologies to be used for its implementation. Specific tasks to be conducted include the following:

- Existing Monitoring Well Search, Inspection and Gauging Activities
- Installation and Sampling of Temporary Monitoring Wells
- Existing Monitoring Well and Piezometer Sampling
- Quality Assurance/Quality Control

All work will be conducted in accordance with a project-specific Health and Safety Plan which is provided as Attachment A of this Work Plan. Details of the specific tasks are described in the following subsections.

2.1 EXISTING MONITORING WELL SEARCH, INSPECTION AND GAUGING ACTIVITIES

The well search, investigation and gauging activities will be conducted concurrent with the implementation of the potential TI Zone investigation as presented in Section 2.2. The results of these activities will be reviewed to determine whether any modifications to Section 2.2 and Section 2.3 are warranted, if any. For example, monitoring wells MW-08, OW-13, MW-24 and MW-25 could not be located during previous monitoring events. An additional attempt to locate these wells will be made as part of this task. If any of these wells are located, they will be inspected to determine whether they could produce representative groundwater samples. If it is determined that representative samples could be produced, then the monitoring wells will be sampled. In the case of wells OW-13 and MW-08, sampling of these wells could preclude the need for an adjacent proposed shallow temporary well. The well search, inspection and gauging activities will include the following:

- Locate all wells associated with the Site (on/off-site) and check the field location to those shown on existing Site maps;
- Check the wells to determine if their respective designations are clearly marked on the outer protective casing or on the inner well cap/casing, if a well is not clearly identified, then its designation will be marked on the outer protective casing;
- Inspect the condition of the well lock and replace if necessary;
- Identify the measurement reference point on the top of the monitoring well casing. If a reference point is not clearly identified, then one will be established by marking the top of the casing with a waterproof marker and a note will be made to have the newly established measuring point surveyed for location and elevation;
- Evaluate the condition of the locking protective well cover surrounding the monitoring well;
- Inspect the condition of the surface seal surrounding the monitoring wells protective cover;

- Identify the construction material and diameter of the inner well casing;
- Measure and record the depth to groundwater in the well;
- Check the well for the presence of DNAPL. If DNAPL is identified in the well, then the apparent thickness of the DNAPL layer will be measured and recorded;
- Measure and record the total depth of the well and compare to the original well depth to determine whether significant sediment has accumulated in the bottom of the well or if an obstruction exists; and,
- Record any other pertinent information (i.e. double-cased well).

2.2 INSTALLATION AND SAMPLING OF TEMPORARY MONITORING WELLS

This task includes the installation and sampling of a total of 33 temporary monitoring wells. The 33 temporary wells are comprised of 15 shallow and intermediate zone well clusters. The remaining three temporary wells are intermediate zone wells that will be paired with an existing shallow zone monitoring well. The temporary wells will be installed at 10 on-Site locations and 8 off-Site locations to the west or south of the Site. At each location, continuous soil sampling and logging will be performed. Lithologies will be described in detail and NAPL presence, along with a qualitative assessment of the degree of saturation (i.e., residual or free-phase) will be noted. Groundwater samples will be collected from each of the shallow and intermediate temporary monitoring wells. Figure 2 presents the proposed soil boring/temporary monitoring well locations. If a particular proposed located is not accessible to the drilling equipment, the boring will be relocated to the nearest accessible location.

2.2.1 Soil Borings and Temporary Well Construction

The soil borings will be advanced into the subsurface using direct push techniques (e.g., Geoprobe®). Before any subsurface work begins, underground utilities in the vicinity of the borings will be located by contacting the Texas One Call System. Boring locations may require adjustment based on the utility locations. The shallow zone borings will be advanced to the top of the clay unit, and are not expected to exceed a depth of 25 feet below ground surface (ft-bgs).

The intermediate zone borings will be advanced to the bottom of the intermediate zone and are not expected to exceed a depth of 60 ft-bgs. However, prior to advancement of the soil borings into the intermediate water bearing zone, an isolation casing (3-inch I.D. Steel) will be installed to prevent potential downward vertical migration from the shallow zone during sampling of the intermediate zone. The isolation casing will be set into the underlying clay unit below the shallow water bearing sand unit. Prior to installation of the casing, pelletized bentonite will be placed into the base of the boring and hydrated to insure a competent seal at the base of the isolation casing.

A continuous soil core will be collected from all of the borings. The soil will be classified by the field geologist according to the Unified Soil Classification System (USCS). Photographs of the soil cores will be obtained as well. Soil descriptions will be recorded on the Soil Boring Log Field Form presented in Attachment B. Soil boring logs will include description of any potential water producing zones that are observed (i.e. thickness of coarser-grained seams), and any

evidence of NAPL presence. Documentation of NAPL presence will include descriptions of odor, color, and qualitative degree of saturation (i.e. residual or free phase). The degree of impact, if any, will be recorded on the boring logs on a depth-specific basis. A qualitative numeric scale will be used to document the degree of impact, as follows:

- 0 – No observed DNAPL, stains, or odors
- 1 – Odor and/or Photo-Ionization Detector (PID) measurements above background
- 2 – Non-natural staining (color) or sheen
- 3 – Residual DNAPL (e.g., droplets, globules) observed (color)
- 4 – Apparent free phase DNAPL present

Note that determination of the presence of DNAPL in the soil cores is best made via removal of a portion of the soil once the soil core is sliced open. Removal of soil that was directly in contact with the liner (along the entire length of the liner) will expose minimally disturbed soil (i.e., soil that has not been subjected to smearing along the liner wall).

A PID will be used to screen the soil core for volatile organic compounds (VOCs). Initially, each core will be scanned along its length with the PID to identify any potentially impacted intervals. Sections of the core will then be retained for head space analysis in approximately two-foot intervals including any potentially impacted intervals identified by the initial scan.

Following the completion of a boring, a temporary monitoring well (one-inch inside diameter PVC pipe) will be installed in each of the borings. The wells will be completed with a natural sand pack (i.e., the formation will be permitted to collapse around the well screen. Information from the Verification of the Groundwater Fate and Transport Evaluation Report (VGFTER) showed that the dissolved constituents of interest preferentially migrate in the lower portion of the shallow aquifer. As such, the screen interval for the shallow temporary wells will be five feet in length and will be set with its base at least six-inches below the interface between the sand unit and the underlying clay. For the intermediate temporary wells the screen interval will be at least 10 feet in length and will be set with its base at least six-inches below the interface between the intermediate sand unit and the underlying clay layer. Previous site investigations have shown that the sandy units within the intermediate zone are not continuous beneath the Site and off-site areas of interest, especially in the southern portion of the study area. Thus, if a boring is advanced to a depth of 60 ft-bgs, and no water producing sand units are present at a particular location, the absence of groundwater will be noted and no temporary well will be installed at that location. If the only sand zones observed in the intermediate zones are at shallower depths, then either the length of the well screen may be increased or the depth of the well adjusted such that the screen interval intersects with the water producing zones.

Following the completion of each soil boring, all downhole equipment will be thoroughly cleaned by washing all surfaces with an Alconox[®] (or equivalent) solution and rinsing with potable water.

2.2.2 Groundwater Sample Collection and Analysis

Once a sufficient volume of water has entered the temporary well, micro-purging of the well using a low flow (peristaltic) pump will be attempted. If the well goes dry in response to purging, the well will be allowed to recover and the sample collected as soon practicable. Otherwise, the sample will be collected after the parameter stabilization criteria specified in the Standard Operating Procedure (Attachment C) have been attained or a minimum of three well volumes have been removed, whichever occurs first. Purge water will be discharged into a bucket or similar container and will be visually inspected for any indication of impact.

Shallow groundwater samples will be collected using a peristaltic pump and dedicated Teflon tubing. To minimize agitation and aeration of the samples, they will be obtained as follows: 1) crimping the tubing upstream of the pump; 2) removing the tubing from the pump body, and 3) draining the groundwater from the tubing directly into the sample vials.

Intermediate groundwater sampling will be collected using low flow/micro-purge methods, similarly as previously discussed for the shallow zone temporary wells. The depth to groundwater in the intermediate zone may preclude the use of a peristaltic pump for purging and/or sample collection. If this is the case, low flow bladder pumps or equivalent will be used for purging and groundwater sample collection.

Field parameters including temperature, pH, conductivity, turbidity, dissolved oxygen (DO), and oxidation-reduction potential (ORP) will be measured at the time of sample collection using a water quality instrument(s). These results will be recorded on field sample log sheets (Attachment B). Observations during both purging and sampling regarding evidence of the potential presence of DNAPL (e.g., sheens, phase separation, spots, globules, color, etc.), if observed, will also be recorded on the sample log sheets.

Groundwater samples will be collected directly into pre-preserved, laboratory supplied containers, and placed immediately on ice. The samples will be shipped to the lab and analyzed for the following constituents:

- Benzene, Toluene, Ethylbenzene and Xylenes (BTEX);
- 16 EPA Priority Pollutant Polycyclic Aromatic Hydrocarbons (PAHs) listed below; and,

Acenaphthylene	Chrysene
Acenaphthene	Dibenzo(a,h)anthracene
Anthracene	Fluoranthene
Benzo(a)anthracene	Fluorene
Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene
Benzo(b)fluoranthene	Naphthalene
Benzo(k)fluoranthene	Phenanthrene
Benzo(g,h,i)perylene	Pyrene

- Total and Dissolved Metals (arsenic, chromium, copper, lead, zinc).

The above analyte list represents the constituents with remedial goals specified in the ROD and the complete list of EPA Priority Pollutant PAHs. Sample analyses will be performed using EPA Method 8260B (for BTEX), 8270C Low Level (for PAHs), and 6020 (for Metals). The Method Detection Limits and Reporting Limits are provided in Section 2.4 of the QAPP (Attachment D). Samples for dissolved metals analyses will be filtered in the field.

All reusable downhole equipment (i.e. pumps, cable, oil-water interface indicator) will be decontaminated between sample locations by washing all surfaces with an Alconox[®] (or equivalent) solution, followed by a deionized water rinse. All purge water and decontamination liquids will be containerized in 55 gallon steel drums, labeled, and staged on site in the area of the on-site water treatment facility.

2.2.3 Temporary Monitoring Well Abandonment

The temporary monitoring wells will be decommissioned in accordance with *Administrative Rules of the Texas Department of Licensing and Regulation 16 Texas Administrative Code, Chapter 76.104: Technical Requirements – Standards for Capping and Plugging of Wells and Plugging Wells that Penetrate Undesirable Water or Constituent Zones.*

The decommissioning procedure for the intermediate zone wells will be as follows:

- The well screen and riser will be removed from the borehole;
- The open borehole will be grouted up to the bottom of the temporary casing with a cement-bentonite mixture;
- The temporary casing will be removed and the open borehole will be grouted to the ground surface; and,
- Each location will be was restored with cement to original grade.

Temporary shallow zone monitoring wells were decommissioned as follows:

- The well screen and riser will be completely removed from the borehole;
- The boreholes will be sealed to the ground surface with a cement-bentonite grout; and,
- Each location will be restored with cement to original grade.

2.2.4 Survey

Each location will be surveyed by a professional surveyor licensed in the State of Texas to determine horizontal location and elevation in reference to the Texas Coordinate System, South Central Zone, and the 1973 United States Coastal and Geodetic Survey adjustment of the 1929 mean sea level datum, respectively.

2.3 EXISTING MONITORING WELL AND PIEZOMETER SAMPLING

Groundwater samples will be collected from twenty-three monitoring wells and piezometers at the Site to supplement the data acquired from the 33 temporary wells. Figure 3 shows the well

and piezometer locations to be sampled. The wells/piezometers to be sampled include the following:

Shallow Zone – Northern Area

PZN-20	OW-07
PZN-30	OW-09
PZN-50	OW-08
MW-01	OW-14
MW-03	

Shallow Zone – Southern Area

MW-04	PZS-30
MW-07	PZS-40
MW-26	PZS-60

Intermediate Zone – Northern Area

P-01	MW-12R
P-04	OW-15 or OW-16 (pending pre-sampling gauging and inspection)
MW-10	

Intermediate Zone – Southern Area

P-02R	MW-14R
P-03R	

Sample collection activities at each location will be recorded on the Groundwater Sample Collection Record (Attachment B). Prior to sample collection, depth to water, depth to DNAPL (if present), and total depth will be measured relative to an established measuring point with an oil-water interface indicator. Groundwater samples will not be collected from monitor wells or piezometers where DNAPL is detected.

Groundwater purging and sampling will be conducted in accordance with the Standard Operating Procedure included as Attachment C. The groundwater sample will be collected in pre-preserved, laboratory-supplied containers and immediately placed on ice. The samples will be shipped to the lab and analyzed for BTEX, PAHs, and metals (arsenic, chromium, copper, lead, zinc). Sample analyses will be performed using EPA Method 8260B (for BTEX), 8270C Low Level (for PAHs), and 6020 (for Total and Dissolved Metals). Samples for dissolved metals analyses will be filtered in the field.

All reusable downhole equipment (i.e. pumps, cable, oil-water interface indicator) will be decontaminated between sample locations by washing all surfaces with an Alconox[®] (or

equivalent) solution, followed by a deionized water rinse. All purge water and decontamination liquids will be containerized for off-site disposal.

2.4 QUALITY ASSURANCE/QUALITY CONTROL

Quality Assurance/Quality Control (QA/QC) for the project is discussed in detail in the Quality Assurance Project Plan (QAPP) provided as Attachment D. A brief summary of planned field QA/QC sampling, a general discussion of sample handling and custody, and an overview of the data usability assessment is provided in this section.

It is anticipated that a total of 56 groundwater samples will be collected as part of the TI Zone Delineation Investigation. As a result, the following QA/QC samples will be collected: three blind duplicates, three equipment blanks, three field blanks and three Matrix Spike/Matrix Spike Duplicates. In addition, one trip blank will accompany each cooler containing groundwater samples for BTEX analyses.

All samples will be cooled to a temperature of 4 degrees Celsius and will be delivered to the laboratory in a timely manner such that the applicable method holding times for analysis are not exceeded. Chain of Custody (COC) documentation will be completed by the field sampling team leader and will accompany the sample shipment to the laboratory.

To ensure the utility of the sample results, a data usability assessment of the analytical data will be completed. This review will be completed by the project QA/QC Officer. The analytical results generated via SW-846 Method 8260B, 8270C, and 6020 will be reviewed in accordance with specific critical components of relevant U.S. EPA guidance for data validation. Specifically, analytical results will be reviewed considering the following general rubrics:

- Sample holding time compliance
- Acceptable surrogate spike recoveries
- Equipment, field and trip blank contamination
- Laboratory method blank artifacts
- MS/MSD RPDs and recoveries
- Field duplicate RPDs

The analytical results will be reviewed to ensure that samples were analyzed within an acceptable time frame (based on the date of sample collection). Surrogate recoveries will be reviewed to determine if the Gas Chromatography/Mass Spectrometry instrumentation was performing adequately. Equipment, field and trip blank results will be reviewed to determine potential extraneous sources of sample contamination. Method blank results will be reviewed to identify the possibility of laboratory contamination of the samples. The MS/MSD results will provide an indication of the precision of the analytical method given the potential for matrix interference effects. The field duplicates will be used to document the precision of the sampling process.

The data usability assessment will be completed in accordance with applicable sections of the following guidance documents: U.S. EPA's Contract Laboratory Program, National Functional

Guidelines for Organic Data Review and National Functional Guidelines for Inorganic Data Review. As required, this guidance document will be used in conjunction with the laboratory SOPs for the respective analytical methods. Professional judgment will be exercised throughout the data assessment effort, particularly for situations that are not addressed or clearly specified in the SOPs or in the guidance documents.

3.0 INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) may include soil cuttings, purged groundwater, decontamination fluids, disposable sampling materials, and personal protective equipment (PPE). All IDW will be contained in labeled, steel 55-gallon drums and temporarily staged at the Site within the fenced area surrounding the groundwater treatment plant. One representative composite soil sample and one water sample will be collected and analyzed to characterize the materials for disposal. Once characterized, the IDW will be properly disposed of off-Site in accordance with applicable state and federal regulations.

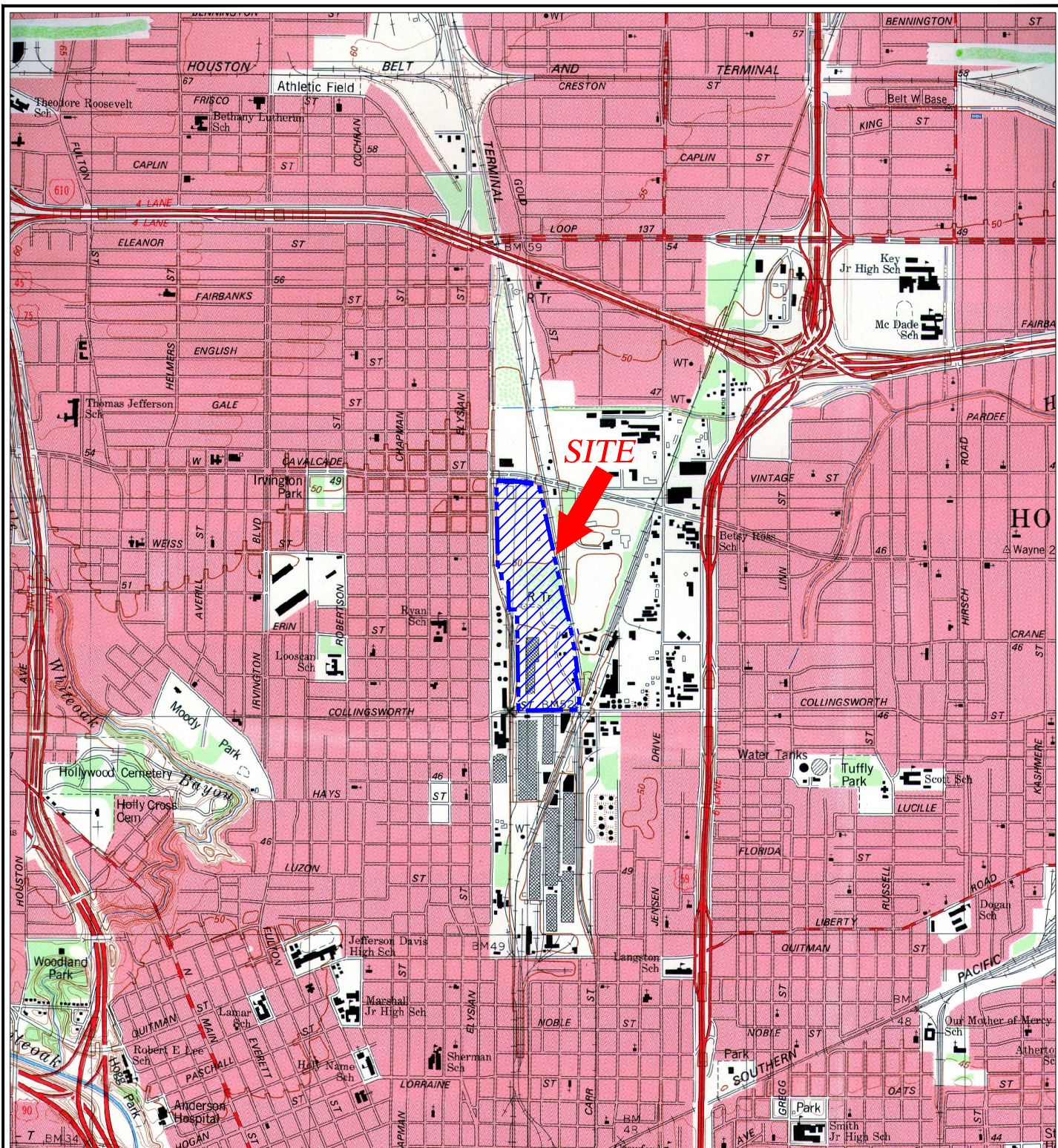
4.0 SCHEDULE AND DELIVERABLES

Pending approval to proceed and access to off-site properties, the field activities can be completed in four weeks. Analyses of the groundwater samples will be completed in one week following completion of field activities. As discussed at the April 9, 2013 meeting, Beazer, EPA and TCEQ will meet upon completion of the field activities, sample analysis, and data compilation to review and evaluate the results. It is planned that preliminary data evaluation, compilation and submittal to EPA and TCEQ will be completed within one week of receipt of the analytical data and that the meeting will occur less than one week following the data submittal. It is anticipated that the scope of the report of findings and schedule for submittal will be finalized during the meeting and that locations for proposed permanent monitoring wells can also be discussed. For preliminary scheduling purposes, it is anticipated at this time that a final report will be submitted within four weeks of the data review meeting.

A proposed project schedule is provided in graphical form as Figure 4. The duration of major activities is displayed and relevant milestones (e.g., mobilization and meeting dates) are depicted on Figure 4. Note that the schedule, as proposed, is based on the assumption that adverse weather conditions will not be encountered during the field effort.

FIGURES

y:\south_cavalcade\13-665\technical impracticability zone delineation\workplan\figure 1.dwg Last Saved By: Sooner 4/29/2013 8:04 AM Plotted By: Shelly Comer 4/29/2013 8:56 AM Scale: 1:10168



QUADRANGLE LOCATION

REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE
OF SETTEGAST, TEXAS - 1982

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

BEAZER EAST, INC
PITTSBURGH, PENNSYLVANIA

DRWN: SCC DATE: 04/17/13
CHKD: JMV DATE: 04/17/13
APPD: JSZ DATE: 04/17/13
SCALE: 1" = 2000'



TECHNICAL IMPRACTICABILITY ZONE DELINEATION WORK PLAN
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

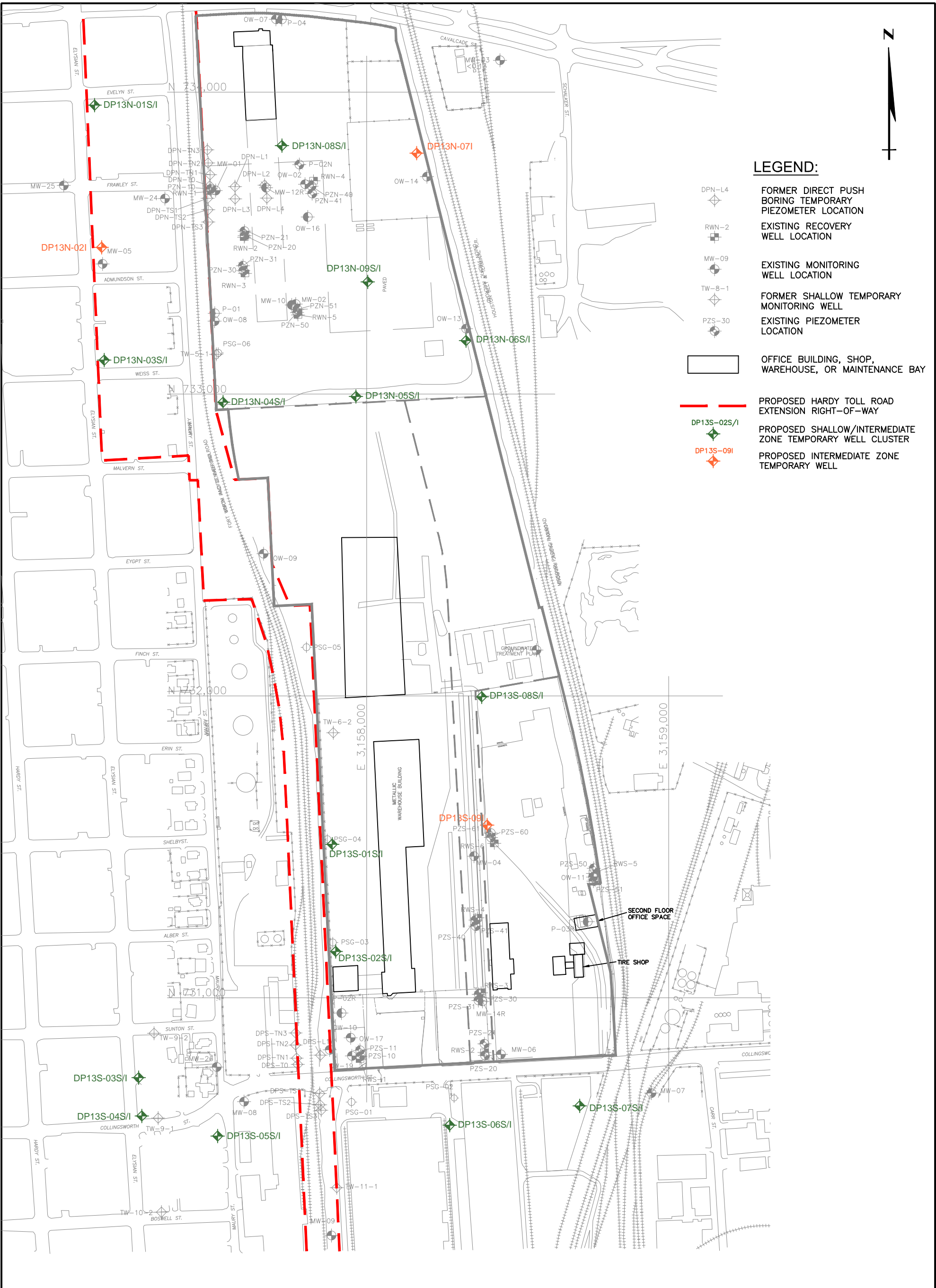
SITE LOCATION MAP

PROJECT NO: 13-665

FIGURE 1

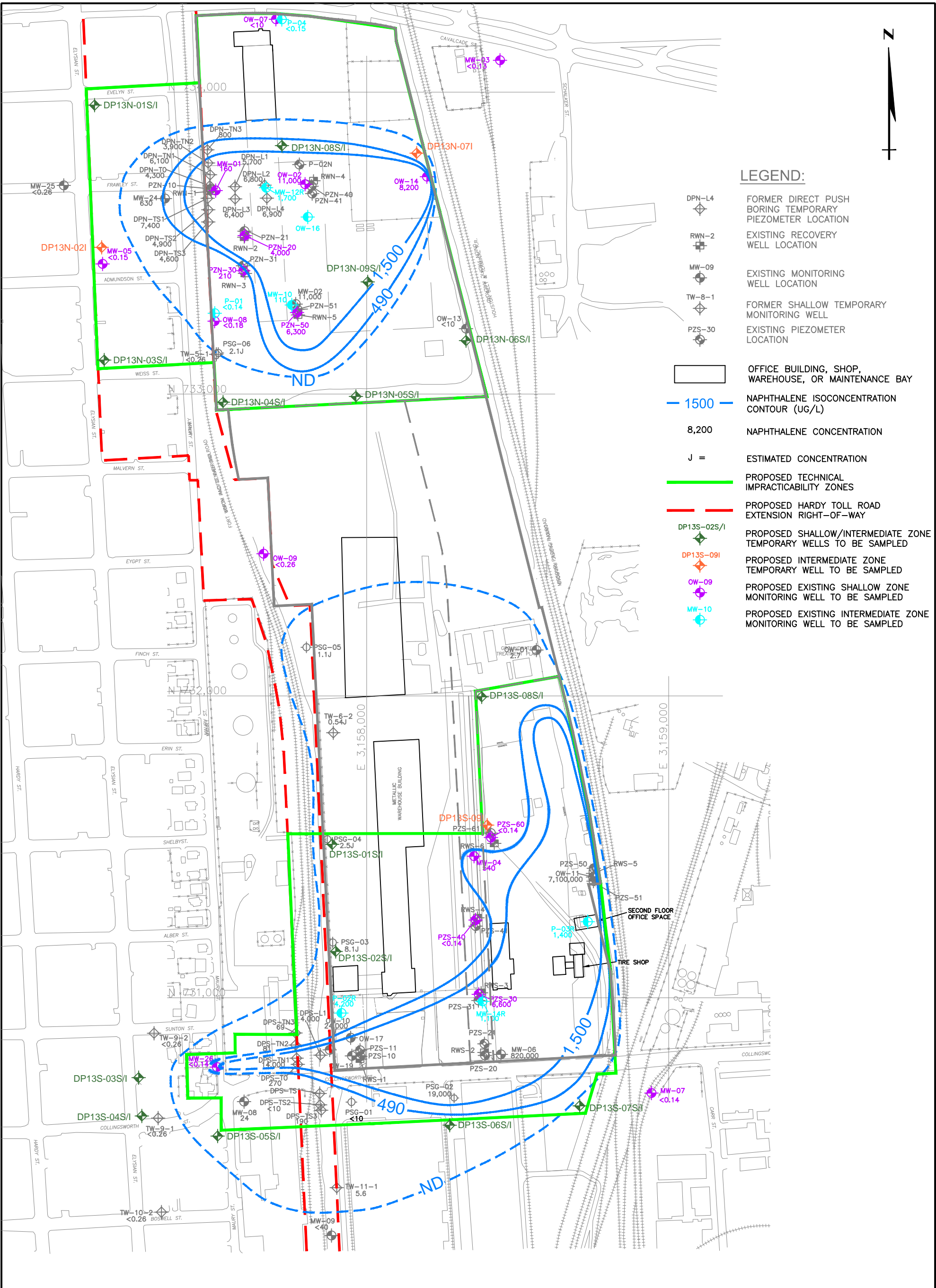
007298

y:\south_cavalcade\13-665\technical impracticability zone delineation workplan\figure 2 proposed soil boring location.dwg shelley corner 1:1 4/29/2013 8:57 AM



REV #				DATE		DESCRIPTION		APPD		REFERENCE:		ISSUE DATE:		KEY ENVIRONMENTAL, INC. 200 THIRD AVENUE CARNEGIE, PA 15106		TECHNICAL IMPRACTICABILITY ZONE DELINEATION WORK PLAN SOUTH CAVALCADE SUPERFUND SITE HOUSTON, TEXAS		PROPOSED TEMPORARY MONITORING WELL LOCATIONS		PROJECT NO: 13-665 FIGURE 2	

y:\south_cavalcade\13-665\technical impracticability zone delineation workplan\figure 3 proposed groundwater sampling.dwg shelly corner 1:1 4/29/2013 8:57 AM



NOTE:

1,500 UG/L ISOCONCENTRATION CONTOUR – TEXAS INDUSTRIAL WATER QUALITY STANDARD
490 UG/L ISOCONCENTRATION CONTOUR – TEXAS RESIDENTIAL WATER QUALITY STANDARD



REFERENCE:

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

BEAZER EAST, INC.
PITTSBURGH, PENNSYLVANIA

DRWN: SCC DATE: 04/17/13
CHKD: JMW DATE: 04/17/13
APPD: JSZ DATE: 04/17/13
SCALE: AS SHOWN



TECHNICAL IMPRACTICABILITY ZONE DELINEATION WORK PLAN
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

PROPOSED GROUNDWATER
SAMPLING LOCATIONS

PROJECT NO: 13-665
FIGURE 3

REV #	DATE	DESCRIPTION	APPD

007300

FIGURE 4
PROJECT SCHEDULE
TI ZONE DELINEATION
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS



Project: Cavalcade TI Zone Inv
Date: Tue 4/30/13

Task

Split

Milestone

Summary

Project Summary

External Tasks

External Milestone

Inactive Task

Inactive Milestone

Inactive Summary

Manual Task

Duration-only

Manual Summary Rollup

Manual Summary

Start-only

Finish-only

Deadline

Progress

ATTACHMENT A
HEALTH AND SAFETY PLAN

**HEALTH AND SAFETY PLAN
TECHNICAL IMPRACTICABILITY ZONE DELINEATION**

**SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS**

Prepared for:

Beazer East, Inc.

Prepared by:

**Key Environmental, Inc.
200 Third Avenue
Carnegie, Pennsylvania 15106**

APRIL 2013

TABLE OF CONTENTS

1.0 INTRODUCTION.....	1-1
2.0 PROGRAM ORGANIZATION AND RESPONSIBILITIES.....	2-1
2.1 WORK PERFORMED BY KEY PERSONNEL	2-1
2.2 SUBCONTRACTOR ACTIVITIES	2-1
3.0 SITE CHARACTERIZATION AND HAZARD ASSESSMENT.....	3-1
3.1 SITE DESCRIPTION AND BACKGROUND.....	3-1
3.2 SCOPE OF WORK.....	3-1
3.3 CHEMICAL HEALTH HAZARDS.....	3-2
3.3.1 PAHs	3-3
3.3.2 VOCs.....	3-3
3.3.3 Work Task Chemical Hazard Assessment.....	3-4
3.4 PHYSICAL HAZARDS.....	3-4
3.5 CONFINED SPACES	3-4
3.6 HEAT STRESS	3-4
3.6.1 Heat Stress Prevention.....	3-4
3.7 OUTDOOR HAZARDS.....	3-5
4.0 MEDICAL SURVEILLANCE	4-1
4.1 PRE-ASSIGNMENT SCREENING	4-1
4.2 SUBCONTRACTORS	4-1
5.0 WORK PRACTICES AND SITE CONTROL	5-1
5.1 SAFE WORK PRACTICES	5-1
5.1.1 Routine Safe Work Practices	5-1
5.1.2 Work Restrictions.....	5-1
5.1.3 Underground and Overhead Utilities	5-1
5.1.4 Geoprobe®	5-1
5.1.5 Opening Wells.....	5-1
5.1.6 Gauging and Sampling Wells.....	5-2
5.1.7 Noise	5-2
5.1.8 Use of Drinking Water or Liquids	5-2
5.1.9 Slip, Trip, Fall.....	5-2
5.1.10 Working in the Street	5-3
5.2 SITE ACCESS/SITE CONTROL.....	5-3
5.2.1 Site Access.....	5-3
5.2.2 Work Zones	5-3
5.3 SITE HOUSEKEEPING	5-4
5.4 SANITATION/CHANGING FACILITIES	5-4
5.5 CONSTITUENT(S) AND EXPOSURE PREVENTION	5-4
5.6 BUDDY SYSTEM	5-4
5.7 SITE COMMUNICATIONS.....	5-4

6.0 PERSONAL PROTECTIVE EQUIPMENT.....	6-1
6.1 SITE-SPECIFIC LEVELS OF PROTECTION	6-1
6.2 UPGRADE CONDITIONS	6-1
7.0 MONITORING.....	7-1
7.1 REAL-TIME MONITORING	7-1
7.2 INSTRUMENT CALIBRATION	7-1
8.0 MATERIAL HANDLING AND DECONTAMINATION.....	8-1
8.1 DECONTAMINATION.....	8-1
8.1.1 Personnel Decontamination.....	8-1
8.1.2 Equipment Decontamination	8-1
8.1.3 Investigation-Derived Waste.....	8-2
9.0 EMERGENCY PROCEDURES	9-1
9.1 EMERGENCY MEDICAL TREATMENT AND FIRST AID	9-1
9.2 EMERGENCY EVALUATION, INVESTIGATION AND DOCUMENTATION.....	9-2
10.0 TRAINING	10-1
10.1 GENERAL	10-1
10.2 SITE-SPECIFIC TRAINING	10-1
10.3 SAFETY MEETINGS	10-1

LIST OF TABLES

1	Exposure Limits and Other Properties of Chemicals
2	Task-Specific Hazard Assessment with Proposed Initial Levels of Protection and Air Monitoring Requirements

LIST OF FIGURES

1	Site Location Map
2	Site Plan

LIST OF APPENDICES

A	MATERIAL SAFETY DATA SHEETS
B	HEALTH AND SAFETY FORMS
C	EMERGENCY CONTACTS AND HOSPITAL ROUTE MAP

1.0 INTRODUCTION

This Health and Safety Plan (HASP) describes Site specific procedures to be implemented by KEY Environmental, Inc. (KEY) employees and sub-contractors when performing additional delineation work activities at the South Cavalcade Superfund Site in Houston, Texas. All work must be performed in accordance with applicable federal, state, and local regulations, including, but not limited to:

U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) - 29 Code of Federal Regulations (CFR) 1910.120, "Hazardous Waste Operations and Emergency Response"; and,

OSHA - 29 CFR 1926, "Safety and Health Regulations for Construction."

The health and safety practices, procedures, and personal protective equipment (PPE) requirements established within this HASP are based on hazards known to be present at this Site. All protective measures employed must be commensurate with known hazards associated with specific work activities and job tasks and must be modified if other hazards are identified during the course of the work.

This HASP should not be used for activities other than those outlined in the scope of work unless a task-specific hazard and exposure assessment is performed and any additional protective measures incorporated into the HASP. This HASP is intended for use by KEY and may not include all subcontractor activities. Contractors or subcontractors performing activities not included in this HASP must prepare their own HASP in accordance with OSHA 29 CFR 1910.120.

2.0 PROGRAM ORGANIZATION AND RESPONSIBILITIES

Certain activities covered by this HASP will be performed by subcontractors working under the direction of KEY while some activities covered by this HASP will be performed by one or two persons from KEY. The following details the safety organization and responsibilities for both scenarios.

2.1 WORK PERFORMED BY KEY PERSONNEL

KEY On-Site Personnel are responsible for:

- Their own safety;
- Ensuring that they have the proper PPE and other necessary safety equipment;
- Ensuring that their training and medical surveillance is up-to-date;
- Becoming familiar with and complying with the HASP;
- Attending training sessions to review the HASP and other safety/health information;
- Being alert to previously identified and new hazards;
- Reporting unidentified hazards to the KEY Health and Safety Manager; and
- Conducting themselves in a manner that is orderly and appropriate for the Site.

KEY Project Manager

The Project Manager is responsible for ensuring that all activities are conducted in accordance with the HASP. The Project Manager has the authority to suspend field activities if employees are in danger of injury or exposure to harmful agents. The Project Manager's responsibilities include:

- Coordinating the development of a Site-specific HASP for all phases of the project;
- Ensuring that the appropriate health and safety equipment and PPE are available for project personnel;
- Ensuring that all personnel have received the appropriate training before they engage in activities that are potentially hazardous;
- Ensuring that all required personnel have received the required medical examination, testing, and screening before engaging in work activities; and,
- Designating a Site Health and Safety Officer (SHSO) and other Site personnel who will ensure compliance with the HASP.

2.2 SUBCONTRACTOR ACTIVITIES

Environmental investigative and delineation activities will include the use of subcontractors. In addition to being responsible for their own safety as outlined above –

The on-site KEY personnel are also responsible for:

- Ensuring that KEY personnel, subcontractor personnel, and visitors comply with the requirements of this HASP; and,
- Notifying the KEY Project Manager or KEY Health and Safety Manager of any changes in work conditions or tasks which may require changes to the HASP.
- Acting as the Site Health and Safety Officer for field activities, whose duties include:
 - Coordinating safety meetings and daily safety briefings, as necessary;
 - Acting as the Emergency Coordinator at the Site and arrange for emergency response in cooperation with local emergency and health officials;
 - Monitoring conditions during field activities to assure compliance with HASP;
 - Monitoring conditions during field activities to determine if more stringent procedures or a higher level of PPE should be implemented;
 - Maintaining a log to record conditions, personnel involved in field activities, and other pertinent health and safety data;
 - Overseeing the arrangement and execution of personnel and equipment decontamination;
 - Suspending field activities if necessary, and resume activities when appropriate, and;
 - Controlling visitor, subcontractor, and employee access to hazardous areas.

Subcontractors are responsible for:

- Becoming familiar with the HASP;
- Complying with the contents of the HASP;
- Implementing their own HASP, or work procedures not covered in this HASP, as necessary and applicable;
- Attending training sessions to review the HASP and other safety/health information;
- Being alert to previously identified and new hazards;
- Reporting unidentified hazards to the KEY SHSO; and,
- Conducting themselves in a manner that is orderly and appropriate for the Site.

3.0 SITE CHARACTERIZATION AND HAZARD ASSESSMENT

3.1 SITE DESCRIPTION AND BACKGROUND

The South Cavalcade Superfund Site occupies approximately sixty-six acres of urban land approximately three miles north of downtown Houston, Texas. The site is rectangular in shape with a length of approximately 3,400 feet in the north-south direction, and a width of approximately 900 feet in the east-west direction. A site location map is provided as **Figure 1** and a site plan is provided as **Figure 2**.

The Site was operated as a wood treating plant from 1910 until 1962 using creosote and various metal salts in the wood treating process. The wood treating process area was located in the southern portion of the Site, along Collingsworth Street. Koppers Company, Inc. (Koppers), now known as Beazer East, Inc. (Beazer), operated the wood treating facility from 1944 until closure in 1962. A coal tar distillation plant was operated by Koppers on the southeastern portion of the Site from about 1944 until 1962. Much of the ground surface, especially in the southern and northern areas of the Site, is covered by concrete or asphalt pavement, or buildings. The central part of the Site is undeveloped. Land use in the vicinity of the Site is a mixture of commercial, industrial, and residential. The nearest residences are located several hundred feet to the west of the Site.

Groundwater monitoring wells and extraction wells have been installed at the Site as a result of previous investigations and the remedial action designated for the Site. A groundwater treatment facility is located along the eastern Site boundary in the central portion of the Site. Dense Non-Aqueous Phase Liquid (DNAPL) is recovered through the extraction wells.

Current activities involve additional delineation of the horizontal and vertical extent of constituents of interest (COI) in the shallow and intermediate groundwater-bearing zones at the South Cavalcade Superfund Site.

3.2 SCOPE OF WORK

The scope of work includes:

- Existing Monitoring Well Search, Inspection and Gauging Activities
 - Locate all on-site and off-site wells associated with the Site;
 - Check wells for identification, condition, construction, and any other pertinent information; and,
 - Measure and record depth readings and DNAPL (if any).
- Installation and Sampling of Temporary Monitoring Wells
 - Install and sample 33 temporary monitoring wells comprised of 15 shallow and intermediate well clusters;
 - Using direct push techniques (Geoprobe®);
 - 10 on-site locations, 8 off-site locations;
 - Measure depth of wells, water, DNAPL;

- Continuous soil sampling and logging, screen with PID; and,
 - Collection of groundwater samples (purging and sampling with low flow pumps, measure field parameters);
 - Temporary monitoring well abandonment - remove well screen and riser, grout borehole with bentonite, restore to grade with concrete; and,
 - Survey each temporary well location.
- Existing Monitoring Well and Piezometer Sampling
 - Measure well depths;
 - Groundwater purging and sampling;
- Equipment decontamination
- Handling investigation derived waste (IDW)
 - Containerize soil cuttings, purge water, and decontamination liquids into 55 gallon steel drums;
 - Stage investigative-derived waste (IDW) temporarily on-site and collect a soil sample and a water sample for analysis prior to disposal.

The work will be performed outside the source area where there is less potential for exposure to potential Site constituents.

3.3 CHEMICAL HEALTH HAZARDS

Potential chemical health hazards at the Site include the potential exposure to creosote/coal tar constituents including polynuclear aromatic hydrocarbons (PAHs), including naphthalene; and to the volatile organic compounds (VOCs) benzene, toluene, ethylbenzene, and xylene (BTEX). The Groundwater Fate and Transport Evaluation Report found the following upper range concentrations of potential constituents¹:

Constituent	Soil (mg/kg)	Groundwater (ug/l)
Benzene	---	780
Toluene	---	340
Ethylbenzene	---	940
Xylenes	---	1,000
PAHs Total	8,597	87,290
Naphthalene	---	43,000

The most likely routes of exposure to Site chemicals are through direct contact with soils and groundwater, and more likely, through direct contact with DNAPL when measuring DNAPL in wells. Concentrations of VOCs are low so there is only a very low potential for exposure to these compounds during work activities.

¹ Key Environmental, Inc. Groundwater Fate and Transport Evaluation Report for the South Cavalcade Superfund Site, 1998.

3.3.1 PAHs

The main route of exposure for creosote compounds, including PAHs, is skin/eye contact and absorption; a secondary route of exposure is inhalation of dust and vapors. The PAHs found on the Site pose only a slight inhalation hazard because they are not very volatile, that is, they are unlikely to vaporize. However, PAHs can cause skin and eye irritation upon contact and can cause systemic poisoning upon prolonged contact, inhalation, or ingestion. Some PAHs can cause cancer after prolonged exposure. However, prolonged overexposure to PAHs is not expected due to the short duration of anticipated project work. OSHA has not established exposure limits for most individual PAHs. Coal tar pitch volatiles is a category that contains several compounds, most of which are PAHs, so coal tar pitch volatiles is used as a surrogate measure for PAHs.

Immediate or acute effects from short-term exposure to coal tar compounds include irritation; burning, itching, redness, skin color changes, and rashes from skin contact with coal tar compounds. Photosensitization, a tendency to sunburn more easily or a worsening of rash with exposure to sunlight, may occur with skin contact to coal tar compounds. Inhalation of coal tar compounds, or dust which contains coal tar compounds, may irritate the respiratory tract. Eye contact may cause eye irritation, burning and inflammation. Ingestion may result in nausea, vomiting, abdominal pain, rapid pulse, respiratory distress and shock. Absorption into the body systems by any route may cause trouble breathing, dizziness, headache, continuous or drawn out pulse, nausea, vomiting, salivation, and convulsions. Chronic or long-term effects of overexposure to coal tar compounds may cause dermatitis, and cancer of the skin, kidneys, and respiratory tract.

Exposure to potential Site constituents can be avoided or limited by the use of gloves and skin protection. For these reasons, potential exposure risks to PAHs are considered to be reasonably low.

3.3.2 VOCs

Benzene, ethylbenzene, toluene, and xylene may pose an inhalation hazard as well as a skin and eye hazard. However, the low concentrations of VOCs in ground water and soil represent a low risk of overexposure to these compounds. Acute or immediate effects of overexposure to VOCs include eye, nose, and respiratory tract irritation, headache, dizziness, drowsiness, shortness of breath, intoxication, nausea, vomiting, abdominal pain, and dermatitis. Severe overexposure may lead to unconsciousness and convulsions, coma, and death. Other signs of overexposure may include heartbeat irregularities, bronchitis, pulmonary edema, muscle spasms, incoordination, and confusion. Effects of frequent or long-term overexposure include headache, nervousness, lack of hunger, pale skin, rash, and sleeplessness. Chronic inhalation may result in lung, liver, and kidney damage. Long-term overexposure to benzene can cause blood disorders, such as leukemia and aplastic anemia. Benzene is a suspected human carcinogen.

Table 1 presents exposure limits and other properties of chemicals that may be present at this Site. More information concerning the health effects of Site chemicals can be found in the Material Safety Data Sheets (MSDS) in Appendix A. The MSDS for coal tar creosote is representative of information concerning PAHs.

3.3.3 Work Task Chemical Hazard Assessment

The overall chemical health hazard assessment for this Site is low. Potential exposure to Site constituents will be reduced or eliminated by following the work practices and using the personal protective equipment (PPE) designated in this HASP. Table 2 indicates the chemical hazards associated with Site work tasks, relative hazard assessment, proposed initial levels of personal protection, and air monitoring requirements.

3.4 PHYSICAL HAZARDS

The primary physical hazards on the Site are those associated with well installation activities. Physical hazards during well installation, groundwater sampling and DNAPL measurements and sampling may include muscle strain, lacerations, struck by and against, and slip, trip and fall. Safe work practices for these potential hazards are outlined in Section 5.0.

3.5 CONFINED SPACES

No confined space entry (CSE) is anticipated for work covered by this HASP. However, if a situation arises that requires entering a confined space then KEY Environmental and OSHA CSE procedures must be followed, including atmospheric testing of the space and completion of a CSE permit before entry. A minimum of two trained employees must be present for any entry.

3.6 HEAT STRESS

A general physical hazard associated with outdoor work during warm weather is heat stress. There are three heat disorders that are of particular concern - heat cramps, heat exhaustion, and heat stroke. *Heat cramps* occur due to the depletion of body salts from sweating. *Heat exhaustion* results from significant loss of body salts and fluid. Its symptoms may include weakness or fatigue, nausea, headaches, and in more serious cases, clammy, moist skin with pale or flushed complexion. *Heat stroke* is the most serious and occurs when the body's system to regulate internal temperature fails. Symptoms of heat stroke are hot, dry skin; mental confusion or delirium; convulsions or unconsciousness; and body temperature of 105°F or higher. In this situation, medical attention is needed immediately; heat stroke may be fatal.

To prevent heat disorders, attention must be paid to such variables as temperature, humidity, air movement, and the physical condition of employees. In addition, breaks must be taken as needed to let the body cool. Liquids designed to replace lost body salts must be provided regularly.

3.6.1 Heat Stress Prevention

Heat stress can occur even when temperatures are considered moderate, such as in spring or fall. The following recommendations should be followed to help reduce heat stress:

- Personnel must drink plenty of liquids to replace body fluids lost to sweating. To prevent dehydration personnel should be encouraged to drink generous amounts of water even if not thirsty. Heat-related problems can happen before the sensation of thirst occurs.

- Cool drinking water, 50°F to 60°F, should be made available to all personnel.
- Only water, or occasionally, electrolyte-balanced drinks, such as Gatorade®, should be used to replace lost fluids due to sweating.
- Beverages containing caffeine, such as colas, coffee, or tea, should be limited or not used because of their diuretic (water depleting) effects.
- Salt tablets should not be used unless prescribed by a physician.
- Self-monitoring of physical condition and buddy monitoring will be essential in order to prevent any heat stress illness. All personnel should be aware of heat stress symptoms and the proper precautions to take if heat stress is observed.
- Rest periods must be provided for all personnel. This means at least 15 minutes in the morning and in the afternoon and at least 30 minutes for lunch. A more frequent rest schedule may be implemented by the SHSO depending on weather conditions and the type of work performed.

3.7 OUTDOOR HAZARDS

Biological hazards present at the Site may include poisonous plants, insects, and animals. Poison ivy and/or poison oak may be present. Contact with the leaves, vine, roots, or sap of poison ivy or poison oak causes a skin rash on many people. All workers must be familiar with the appearance of poison ivy (three leaves) and wear impervious protective clothing as necessary to prevent contact with poison ivy. Poison ivy/oak can still cause a reaction even in cold weather because the sap is still in the plant.

Ticks may be present throughout the Site on brush, grass, and weeds. Some ticks carry disease, such as Lyme disease or Rocky Mountain spotted fever. Wear protective clothing or secure pant legs to lower leg or boot and apply bug repellent to this area as noted below for mosquitoes. Frequently assist each other in inspecting for ticks. If a tick is found attached to the skin, do not attempt to pick the tick off the skin with fingernails or scrape with a credit card, etc. Carefully remove the tick with tweezers taking care that all parts are removed. Thoroughly scrub the area with soap and water. Save the tick in a small jar or plastic bag and take it to a doctor or health department for identification. If a red circle or rash forms in the area of the tick bite or if flu-like symptoms appear in a few days or weeks consult a doctor for treatment.

A particular hazard at this Site during warmer weather is mosquitoes. Besides the annoyance of the buzzing insects and ordinary mosquito bites, some mosquitoes can transmit West Nile Virus and other diseases. West Nile Virus can be a serious disease, especially for people over 50 years old. Most people have no symptoms after infection but some people have mild symptoms that can include fever, headache, body aches, nausea, vomiting, and swollen lymph glands or a skin rash on the chest, stomach and back. Symptoms last a few days to several weeks. A few people develop severe illness. Symptoms may include high fever, headache, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, numbness and paralysis. Symptoms may

last several weeks and neurological effects may be permanent. People older than 50 are at a higher risk to get sick. A very few people may die from a West Nile virus infection.

The best way to prevent West Nile Virus is to avoid being bitten by mosquitoes. When working outdoors wear light-colored long sleeve shirts, long pants and socks sprayed with insect repellent. Use repellent carefully! Follow the manufacturer's directions for the repellent you are using. Repellents with DEET (N, N-diethyl-meta-toluamide) or permethrin are effective against mosquitoes and other biting insects. You can use DEET directly on your skin and clothing but do not use on skin under clothing. Use permethrin only on clothing, not directly on skin, and let sprayed clothing dry before use. Repellents with a higher concentration do not mean they work better but that they work longer.

Sweating or getting wet may mean you need to re-apply repellent more frequently. If possible wash exposed skin before re-applying repellent. Be sure to wash skin that was sprayed with repellent at the end of the day. Wash hands before eating or using the restroom.

Wasps, bees and other stinging insects may also be found at the Site. Use of DEET of repellent containing permethrin will help keep wasps and bees away. However, if a nest is disturbed the repellent will not help. Be alert for bees flying into and out of a particular area, hanging nests, and nests in logs, pipes and other structures. Wear light-colored clothes as darker clothes tend to annoy some stinging insects.

First aid for insect bites and stings includes: applying a baking soda paste of ice wrapped in a wet cloth. Commercial bee sting kits may be helpful. Honeybees leave their stingers in the body; these can be removed by gently scraping the skin, working side to side of the stinger. A bee sting or snake suction device can also be used. If an insect bite becomes red or inflamed or the person becomes dizzy, nauseous, or short of breath then get to medical care immediately.

Poisonous red ants or fire ants also may be found at the Site. These ants usually build mounds in open sunny areas and near rotting logs, around tree stumps, and sometimes near buildings. They are attracted to electrical fields and may sometimes be found around electrical housings and installations and also around well pipes. Fire ant stings are painful and the venom leaves a white pustule. Symptoms of a fire ant sting include burning and itching as well as the white pustule which may take a day or two to form. Fire ants can sting repeatedly and will attack anything that disturbs their nest. Although stings are not usually life threatening, multiple stings may lead to secondary infections.

The best protection in areas of heavy fire ant infestation is to wear boots with pant legs tucked in or taped to boots so ants cannot crawl up under pant legs. In areas of where ants are less concentrated continual vigilance is needed to ensure that ants do not crawl onto personnel. If stung treat the area with an insect bite remedy that deadens pain and protects against infection. Get medical help in case of multiple stings; or if a person reacts severely to stings.

Avoid unnecessary contact with animals. Some animals may carry disease or poison or may cause injury by biting. If an animal is acting strangely, or if a wild animal approaches humans, leave the area. If necessary, call animal control personnel. Do not try to feed wild animals.

Snakes may also be present on the Site. Leave snakes alone, do not attempt to catch or kill. Stay out of tall grass, brush, and wood or rock piles. Keep hands and feet out of areas you cannot see. If bitten, get the person to medical help immediately. If practical, try to quickly identify the type of snake or at least the color and markings and size. First aid for snake bites includes: Wash the bite with soap and water or antiseptic cleanser, immobilize the bitten area and keep it lower than the heart, cover the area with a clean, cool compress or a moist dressing to minimize pain and swelling. Keep the victim calm and comfortable. If the victim cannot reach medical care within 30 minutes apply a bandage, wrapped 2 to 4 inches above the bite, to help slow the venom. This should not cut off the flow of blood from a vein or artery – the band should be loose enough to slip a finger under it. Without cutting, place a suction device over the bite to help draw venom out of the wound. Continue alternating suction and application of a compress while transporting to a doctor or hospital. Do not give the victim food or alcohol and only limited other liquids as necessary.

4.0 MEDICAL SURVEILLANCE

4.1 PRE-ASSIGNMENT SCREENING

KEY employees who work at this Site must have a current medical screening and approvals for Site work in accordance with 29 CFR 1910.120 (f) and KEY medical screening policies and procedures. This screening includes:

- Medical history;
- Occupational history;
- Physical examination;
- Determination of fitness to work wearing protective equipment and respirators;
- Baseline laboratory studies; and,
- Medical evaluation to determine employee's ability to wear a respirator (for employee's who may wear a respirator).

Employees engaged in work with potential exposure to hazardous materials must undergo a periodic update of medical and occupational history and a periodic physical examination equivalent to the pre-assignment exam. Medical examinations must also be made available to any employee that has developed, or believed he has developed, signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or if the employee has been injured or exposed above the permissible exposure limit (PEL) or published exposure levels in an emergency situation.

4.2 SUBCONTRACTORS

Subcontractors performing work under this HASP are required to have medical training as above. In general, subcontractors who will perform work at this Site where there is a potential for contact with Site constituents are required to follow the medical surveillance requirements of 29 CFR 1910.120 and a medical surveillance program. Subcontractors who perform work where there is no potential for exposure to Site constituents, are not required to follow the medical surveillance requirements of 29 CFR 1910.120.

5.0 WORK PRACTICES AND SITE CONTROL

5.1 SAFE WORK PRACTICES

5.1.1 Routine Safe Work Practices

Proper personal hygiene and the buddy system are integral parts of safe work practices and must be followed by all KEY employees while working at the Site:

- Site activities that involve serious hazards should be performed by a work team of at least two people. Site personnel may use judgment and be flexible in defining when two persons must be present.
- Hygienic practices consistent with work hazards are necessary. Eating and food preparation will be prohibited in any area other than those designated and properly protected. No food or tobacco products will be permitted in work areas. Beverages are only permitted as noted in Section 5.1.8. Employees who handle potentially contaminated materials or articles will wash with soap or mild detergent and water before eating or using the rest room.

5.1.2 Work Restrictions

All outdoor work at the Site must be conducted during daylight hours unless adequate lighting is provided. Outdoor work must cease immediately upon the signs of impending thunderstorms and lightning or other severe weather, as determined by the SHSO.

5.1.3 Underground and Overhead Utilities

Underground utilities and pipelines can present special hazards such as electrocution, sudden release of pressure (gas or liquid), and explosion and fire. Check with Facility personnel and contact local utilities before drilling or other subsurface work and/or call the Houston One-Call Center at 1-800-669-8344. Check for any overhead wires before work. Keep equipment at least 20 feet away from overhead lines.

5.1.4 Geoprobe®

Personnel working on or near the Geoprobe® must be aware of the hazards of the equipment and follow the manufacturer's use recommendations. Particular hazards include pinch points when raising/lowering and other movement of the probe, pinch points when "hammering", and hot hydraulic fluid in the hoses. Unauthorized personnel must not attempt to operate the Geoprobe®. Hearing protection should be worn when operating or working near the Geoprobe®.

5.1.5 Opening Wells

Opening wells may release vapors of potentially hazardous site constituents, which have concentrated in the headspace of wells. Precautions to prevent exposure include:

- Open wells carefully and allow to vent before taking measurements or sampling;
- Stand to the side and avert face when opening wells.

5.1.6 Gauging and Sampling Wells

These activities increase the potential for exposure to Site constituents that can cause eye, skin and respiratory tract irritation, burns and photosensitization. Care must be taken to wear long sleeves, nitrile gloves, and safety glasses, especially when manually bailing, to limit exposure from DNAPL on the rope and bailer. Attempt to bail in a manner that limits the whipping of rope during the process. A Tyvek suit or apron may be needed if there is a potential for getting DNAPL on oneself during sampling, measuring, or when deconning the measuring tape.

5.1.7 Noise

Employees working on or near noisy equipment must wear hearing protection if the 8-hour time-weighted average noise level exceeds 85 decibels. A general field rule is that hearing protection must be used if normal speech cannot be understood within an arms length of the person talking.

5.1.8 Use of Drinking Water or Liquids

All carrying containers and cup dispensers must be closed and covered to protect against dust and vapors.

- Only disposable cups may be used to dispense and drink liquids.
- Use a cup dispenser so that one cup may be easily removed at a time and no other cups are touched.
- Cups may not be reused. (One use may be several consecutive refills. Do not set a cup down and reuse that same cup during the next break.)
- Remove or clean soiled gloves before using a cup.
- Thoroughly clean and decontaminate the drink container and cup dispenser before refilling and before taking them off-Site.

5.1.9 Slip, Trip, Fall

Hazards found at the Site and areas where groundwater sampling occurs may include uneven terrain, holes, ditches, unstable slopes, slippery surfaces, unmarked projections, and ground debris that can cause employees to trip and fall. Take care to notice and avoid unsafe site conditions.

- Visually examine the walking area;
- Test your footing;
- Make sure the walking/work area is adequately lit;
- Be aware of ground debris; remove broken glass, nails, wire, and other debris if possible, or mark off and avoid areas of heavy debris.

5.1.10 Working in the Street

Some locations of wells are located in or adjacent to streets near the Site. Potential hazards include personnel and vehicle accidents. Follow these precautions when working near or in the street:

- Contact Houston public works or police department to ascertain the proper procedures for working near or in the street.
- If needed, hire an off-duty police officer to direct traffic during work activities.
- Wear reflective vests at all times when working near or in the roadway.
- Place traffic cones 25-50 feet ahead of and behind the work area.
- Place traffic cones or around the immediate work area.
- Place traffic safety barricades ahead of and behind the work area.
- Park vehicles off the street or parallel to and ahead/behind the work area.
- Be careful when entering and leaving vehicles – watch for oncoming traffic and wait to open doors.

5.2 SITE ACCESS/SITE CONTROL

Reduce or eliminate the possibility of exposure or transfer of contaminated substances through the following methods, as appropriate for the work task(s):

- Set up barriers to exclude personnel from contaminated areas;
- Minimize the number of personnel and equipment at the Site;
- Establish work zones within the Site;
- Establish control points with regular access to and egress from work zones;
- Conduct operations in a manner to reduce exposure of personnel and equipment; and,
- Implement appropriate decontamination procedures.

5.2.1 Site Access

The Site is enclosed by fencing. Access for authorized personnel is through a locked gate on Cavalcade Street. The SHSO will be responsible for security around the exclusion/work zones.

5.2.2 Work Zones

Exclusion zones for well installation should be established approximately 20-25 feet around the Geoprobe®. Once the well is installed and the rig moves to a different area that particular EZ ceases to exist. Unauthorized personnel may be kept out of these areas with signs or verbal warnings.

Specific work zones are not necessary for tasks where there is little chance of overexposure to Site constituents to others. These tasks include ground water and soil sampling.

At least partial decontamination of personnel and equipment should occur at work areas when appropriate. A separate, common decontamination area(s) should be set up to allow for personnel decontamination as well as equipment decontamination after work is complete for each day. The SHSO must determine the appropriate Site zones upon arrival at the Site and before intrusive

activities begin. The location of the Site work zones may change with the work and the type of activity performed.

5.3 SITE HOUSEKEEPING

The Site must be kept in a neat, organized, and orderly fashion. Items, such as tools, equipment, hoses, *etc.*, must be kept picked up to minimize tripping and falling hazards. Used disposable clothing and equipment must be placed in drums or plastic bags immediately upon removal and the drum lids replaced or bags closed.

5.4 SANITATION/CHANGING FACILITIES

Appropriate sanitation must be used on-Site, including, but not limited to, the following:

- Maintaining an adequate supply of potable water.
- Access to nearby sanitary facilities, including adequate toilets and wash facilities.

5.5 CONSTITUENT(S) AND EXPOSURE PREVENTION

Exposure to hazardous or contaminated materials must be kept to a minimum by adherence to the recommended PPE and decontamination procedures. All Site personnel must avoid potential exposure to Site constituents when possible, e.g., do not handle potentially contaminated materials without proper PPE, do not stand downwind during excavation or other subsurface activities, etc.

5.6 BUDDY SYSTEM

Personnel must adhere to the buddy system when conducting field activities, meaning that they must work in groups of at least two when wearing PPE or when working in an exclusion zone.

5.7 SITE COMMUNICATIONS

- Verbal and Hand Signals - will be the main types of Site communication.
- Telephones - Cell phones may be used for off-Site communication, if necessary.

6.0 PERSONAL PROTECTIVE EQUIPMENT

6.1 SITE-SPECIFIC LEVELS OF PROTECTION

The level of protection for most Site activities will be Level D or a modified Level D. Level D will consist of:

- Long or short sleeve shirts (as appropriate for the season) and long pants.
- Appropriate gloves for material handling activities
- Steel-toe and shank safety boots
- Hard hat.
- Safety glasses with side shields.
- Hearing protection as required.

Level D plus nitrile gloves may be used for most, if not all, Site activities where the only contact with potential site constituents is handling soil/sediment samples or ground water during sampling.

A Modified Level D may be needed for activities that increase the chance for skin exposure to DNAPL. Modified Level D may consist of Level D as above plus the following as appropriate for the activity:

Modified Level D will consist of Level D as above plus:

- A regular Tyvek or polycoated Tyvek suit or apron to avoid body/clothes contact;
- Nitrile inner gloves;
- Nitrile outer gloves as necessary; and,
- Nitrile Rubber or chemically resistant overboots.

6.2 UPGRADE CONDITIONS

If conditions should change where there is a possibility of overexposure to vapors or dust then vapor/dust suppression techniques used, or employees should work upwind to reduce potential exposures. If these measures do not reduce vapor and/or dust concentrations below the acceptable limits set forth in Section 7.0, then contact the KEY Health and Safety Manager for information on how to proceed.

Level C or Level B protection is not expected to be necessary during Site activities. The SHSO has the responsibility for monitoring Site and work task conditions and deciding the appropriate level of protection based on the air monitoring guidelines presented in Section 7.0 and any other indications of potential exposure.

7.0 MONITORING

7.1 REAL-TIME MONITORING

Monitoring for organic vapors must be conducted prior to and during all intrusive Site activities (soil boring and well installation). A Photoionization Detector (PID) with a 10.2 /10.6 electron volt (eV) bulb must be used to conduct air monitoring for organic vapors. Periodic air monitoring should be conducted in the work zone and in the breathing zone of workers. Readings should be recorded prior to and during initial subsurface activities, whenever there is a reading above background, and at least once per hour during work activities. Readings may be recorded on the Real-Time Monitoring Log (Appendix B) or in the field logbook.

Air monitoring is not required as part of groundwater sampling or depth measurements, or for DNAPL thickness measurements.

For any work activity, a sustained (greater than 5 minutes) organic vapor level in the breathing zone above the concentrations in the following table will require vapor suppression techniques or working upwind of the source. If these methods are not feasible or do not reduce the potential exposure below acceptable levels, then employees must upgrade to Level C protection.

AIR MONITORING ACTION LEVELS			
Constituent	Concentration	Location	Response
Total Organic Vapors	1 to 10 ppm	Breathing Zone in Work Area	Continue PID for 5 to 15 minutes. If reading still exceeds 1 ppm use vapor suppression or work upwind.
Total Organic Vapors	10 to 50 ppm	Breathing Zone in Work Area	Stop work and call the KEY Health & Safety Manager.
Total Organic Vapors	>50 ppm	Breathing Zone in Work Area	Evacuate area until vapors dissipate. Monitor from a distance. Contact the Project Manager for instructions before proceeding.

7.2 INSTRUMENT CALIBRATION

Monitoring equipment must be calibrated and checked for proper operation daily before the start-up of any field activities requiring monitoring. Before initiating field activities, background measurements should be obtained with each instrument upwind and away from potential Site influences. Instrument calibrations and background levels must be documented on daily air monitoring logs or in a field log. A Rae Systems PID with a 10.2 eV or 10.6 eV lamp, or equivalent monitor, will be used to monitor for organic vapors.

8.0 MATERIAL HANDLING AND DECONTAMINATION

All waste material, decontamination liquids, and decontamination equipment must be handled in a safe and healthful manner. Decontamination and material handling activities must be carried out within the appropriate work zone.

8.1 DECONTAMINATION

A personnel decontamination area must be provided where surface constituent(s) and outer protective equipment are removed. This area must be determined upon arrival at the Site and before any intrusive activities begin.

8.1.1 Personnel Decontamination

The general decontamination procedure is as follows.

Level D Decontamination:

- Equipment drop onto plastic drop cloth.
- Wash and rinse boot covers and gloves if to be reused.
- Remove and dispose of Tyvek suit in a plastic-lined container or plastic bag.
- Remove boot covers and gloves, dispose in plastic bag or lined containers if not to be reused. Place in "decontaminated PPE" container if to be used again.
- Field-wash hands and face.

There may be partial field decontamination before traveling from one work location to another. This may consist of removing or cleaning boots or boot covers and outer gloves after completing an activity and before moving to the next workstation. The SHSO must advise the field crew of any necessary field decontamination procedures. The SHSO is responsible for monitoring the effectiveness of decontamination procedures and modifying the procedures as necessary to ensure proper decontamination.

8.1.2 Equipment Decontamination

All equipment used in an exclusion zone must be decontaminated before it leaves the Site or is taken into a clean area. Small tools and equipment used in the EZ that become contaminated may be taken to the decontamination area taking care to isolate the tools/equipment from clean materials and equipment. Equipment may be decontaminated by washing with detergent and water then rinsing, or other appropriate decontamination methods. Vehicles that contact potentially contaminated soil or water must be decontaminated before leaving the Site by brushing clean and washing as necessary. Verification that equipment/vehicles leaving the Site have been adequately decontaminated is the responsibility of the SHSO.

8.1.3 Investigation-Derived Waste

Investigation derived waste (IDW) may include soil cuttings, purged groundwater, decontamination fluids, disposable sampling materials, and personal protective equipment (PPE). All IDW will be contained in labeled, steel 55-gallon drums and temporarily staged at the Site within the fenced area surrounding the groundwater treatment plant. One representative composite soil sample and one water sample will be collected and analyzed to characterize the materials for disposal. Once characterized, the IDW will be properly disposed of off-Site in accordance with applicable state and federal regulations.

9.0 EMERGENCY PROCEDURES

The HASP for this project has been established to allow project activities to be conducted without adverse impacts on worker health and safety. In addition, supplementary emergency response procedures have been developed to cover extraordinary conditions that might possibly occur at the Site. Emergency telephone numbers, directions to the nearest hospital, and a route map to the hospital are presented in Appendix D.

Pre-emergency planning consists of the preparation of this emergency response plan, posting of the emergency contact list and hospital route map, assigning emergency functions to on-Site personnel, training of personnel as necessary, and ensuring that emergency procedures and equipment are in place.

The KEY Supervisor/SHSO is designated as the Site Emergency Coordinator for KEY's activities and is responsible for field implementation of this emergency response plan and has full authority for KEY personnel and subcontractors in the event of an emergency. If outside agencies respond to an emergency, the Site Emergency Coordinator will pass the responsibility and authority for emergency response to the Incident Commander for the outside agency as appropriate. The Site Emergency Coordinator will assist outside emergency response agencies as much as possible to control and resolve the emergency. In general, on-site personnel would immediately evacuate the area to the designated safe place of refuge. Communications consist of verbal and hand signals on-site and use of a portable telephone for off-site communication.

The Site Emergency Coordinator, or if the Site Emergency Coordinator is unavailable, the designated alternate on Site, will contact emergency personnel. In the event of severe injury to KEY personnel or subcontractors, KEY personnel may start first aid then contact outside personnel for assistance.

PPE and emergency equipment will be available on-Site for response to minor emergencies. PPE includes gloves, protective clothing, protective booties, and safety glasses. An emergency first aid kit will also be available on-site.

Evacuation routes, safe distances, and places of refuge will be determined before the start of work at the Site and the locations made known to all personnel who enter the Site. These may be modified at the start of each work day based on site specific or work task factors. The SHSO will maintain security around the immediate Site work zones. Because of the limited number of personnel expected to be working on the Site, the SHSO will know who is on Site and can control entry of personnel into hazardous areas in an emergency.

9.1 EMERGENCY MEDICAL TREATMENT AND FIRST AID

In the event of a safety or health emergency at the Site, appropriate emergency measures will immediately be taken to assist those who have been injured or exposed and to protect others from hazards. The project field personnel will take the injured party and transport (if possible) to the nearest hospital for treatment, after determining whether personnel decontamination can be performed on the injured party.

If the injury to a worker is chemical in nature (e.g., overexposure), the following first-aid procedures will be instituted:

- Eye Exposure - If a solid or liquid gets into the eyes, wash the eyes immediately at the emergency eyewash station using large amounts of water and lifting the lower and upper lids occasionally to help flush the eye. Do not let the victim rub eyes or keep eyes tightly closed. Flush for at least 15 minutes. Obtain medical attention immediately.
- Skin Exposure - Promptly wash the area using mild soap and flooding amounts of water for at least 15 minutes while removing contaminated clothing and shoes. Consult a physician for reddened or blistered skin.
- Swallowing - Do not induce vomiting! Never give anything by mouth to an unconscious person. Call poison control center: Akron Regional Poison Center, (800) 362-9922.
- Breathing - If a person has difficulty breathing, move the exposed person to fresh air at once. Do not use mouth-to-mouth respiration. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and mask. Keep the affected person warm and at rest. Obtain medical attention as soon as possible.

First aid supplies must be immediately available at the site. Personnel performing work must have a first aid kit as part of their field supplies. First aid kits will consist of appropriate items for the work being performed and anticipated emergencies. In addition, a portable eyewash bottle and solution should be part of the first aid supplies taken to the Site.

Employees that will work at the Site are responsible for checking the contents of the first aid kit before the kit is sent to the job site to ensure that all required items are present and that expended items are replaced. This employee is also responsible for ensuring that the kit is readily accessible at the site. When more than one person is on site the most senior person has the responsibility for the contents of the kit.

9.2 EMERGENCY EVALUATION, INVESTIGATION AND DOCUMENTATION

The Site Emergency Coordinator will evaluate the available information about the incident and KEY's emergency response capabilities including what happened, any injuries or casualties, further accident potential, and what can be done to remedy the emergency. The type of response action will be based on the available information about the emergency incident.

The emergency incident will be investigated by KEY and all findings put in writing as soon as conditions return to normal. The KEY Supervisor/SHSO will ensure that documentation is as complete as possible by including a chronological history of the incident, facts about the incident and when they became available, titles and names of personnel and composition of teams, actions made, orders given, actions taken, samples and results, possible exposures, and a history of all injuries or illness during or as a result of the emergency. After the situation has returned to normal, all aspects of the emergency incident and the response will be reviewed to assess procedures used, how to improve response, and how to prevent further emergencies.

10.0 TRAINING

10.1 GENERAL

All employees or other personnel entering the Site (other than the support zone) that are also involved in operations that could involve exposure to hazardous waste must receive training in compliance with OSHA 29 CFR 1910.120(e). The training requirements are intended to provide employees with the knowledge and skills necessary to perform hazardous waste site operations while minimizing the potential for injury. Initial training consists of a minimum of 40 hours of off-Site classroom and practical exercise training and 3 days of actual field experience. Training must be updated annually with 8 hours of off-Site training. Supervising personnel will complete an 8-hour training session for supervisors. Training must be certified by record and/or certificate.

10.2 SITE-SPECIFIC TRAINING

Site-specific training must consist of an initial health and safety briefing on the following information:

- Names of individuals responsible for Site health and safety and methods of communicating safety and health concerns;
- Site-specific health and safety hazards;
- Use of PPE;
- Work practices by which employees can minimize risk;
- Safe use of equipment on-Site;
- Recognition of symptoms and signs of exposure to hazardous materials;
- Site control measures;
- Decontamination procedures; and,
- Emergency response procedures.

The SHSO or Site supervisor should give the health and safety briefing prior to initiation of field activities. This briefing must be of sufficient duration to address all of the material covered in this HASP. All personnel that will be participating in field activities must have the opportunity to read this HASP prior to this initial meeting so that any questions they have can be addressed at the initial meeting.

10.3 SAFETY MEETINGS

Prior to commencing field activities each day, a short briefing may be conducted by the Site Supervisor to address the day's activities. The daily briefing also provides the opportunity for the SHSO to address any special health and safety issues and to notify individuals of any deficient areas that need to be corrected or operational changes made that affect field work. The briefing should emphasize the specific concerns associated with the day's planned field activities. Daily weather reports should be reviewed to determine work/rest regimens.

TABLES

TABLE 1
EXPOSURE LIMITS AND OTHER PROPERTIES
OF POTENTIAL SITE CONSTITUENTS
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

Constituent	Exposure Limits ^[b]	STEL ^[c]	IDLH ^[d]	Vapor Pressure ^[e]	Ionization Potential ^[f]
Coal Tar Pitch Volatiles (PAHs) ^[a]	0.2 mg/m ³	---	80 mg/m ³	Varies	Varies
Naphthalene	10 ppm	15 ppm	250 ppm	0.08 mm	8.12 eV
Benzene	0.5 ppm	5 ppm	500 ppm	75 mm	9.24 eV
Ethylbenzene	100 ppm	125 ppm	800 ppm	7 mm	8.76 eV
Toluene	50 ppm	---	500 ppm	21 mm	8.82 eV
Xylene	100 ppm	150 ppm	900 ppm	9 mm	8.56 eV

Constituent	Carcinogen ^[g]	Skin Exposure ^[h]	LEL/UEL ^[i]	Odor Threshold ^[j]	3M/NIOSH Respirator Selection ^[k]
Coal Tar Pitch Volatiles (PAHs)	YES	YES	---	---	R95 or P95
Naphthalene	YES	NO	0.9 - 5.9%	0.015 ppm	OV
Benzene	YES	NO	1.2 - 7.8%	8.65 ppm	OV
Ethylbenzene	NO	NO	0.8 - 6.7%	2.3 ppm	OV
Toluene	NO	YES	1.1 - 7.1%	0.16 ppm	OV
Xylene	NO	NO	1.0 - 7.0%	0.324 ppm	OV

Notes:

- [a] OSHA has not established individual exposure limits for most PAHs. Coal Tar Pitch Volatiles is a category containing several compounds, most of which are classified as PAHs; so Coal Tar Pitch Volatiles can be used as a surrogate for PAHs.
- [b] Exposure Limit: 8-hour Time Weighted Average (TWA) from the Threshold Limit Values of the ACGIH, or OSHA Permissible Exposure Limit (PEL), whichever is lower.
- [c] STEL: Short Term Exposure Limit, denotes a 15 minute average that may not be exceeded.
- [d] IDLH: Immediately Dangerous to Life or Health - Maximum concentration from which one could escape within 30 minutes without a respirator and without experiencing any irreversible health effects.
- [e] Vapor Pressure: From NIOSH Pocket Guide to Chemical Hazards. Water = 0 mm. Above 1 mm is considered volatile; above 100 mm is considered highly volatile
- [f] Ionization Potential: Expressed in electron volts (eV) from NIOSH Pocket Guide to Chemical Hazards. Used to determine type of detector bulb for the PID.
- [g] Carcinogen: "Yes" indicates compound is a confirmed or suspected human carcinogen by NIOSH, OSHA or ACGIH.
- [h] Skin Exposure: "Yes" indicates potential significant exposure through skin and mucous membranes, either by airborne or, more particularly, by direct contact to ambient vapors.
- [i] LEL/UEL: Lower and upper explosive limits. Percent of material needed in air for ignition when exposed to an ignition source.
- [j] Odor Threshold: Air concentration at which most people can smell the chemical.
- [k] 3M/NIOSH Respirator Selection: Type of respirator recommended by the 3M Respirator Selection Guide or the NIOSH Pocket Guide to Chemical Hazards. SA = Supplied Air (Level B); OV = Organic Vapor Respirator (Level C); N, R, or P 95, 97, or 100 = Dust and mist respirator (Level C).

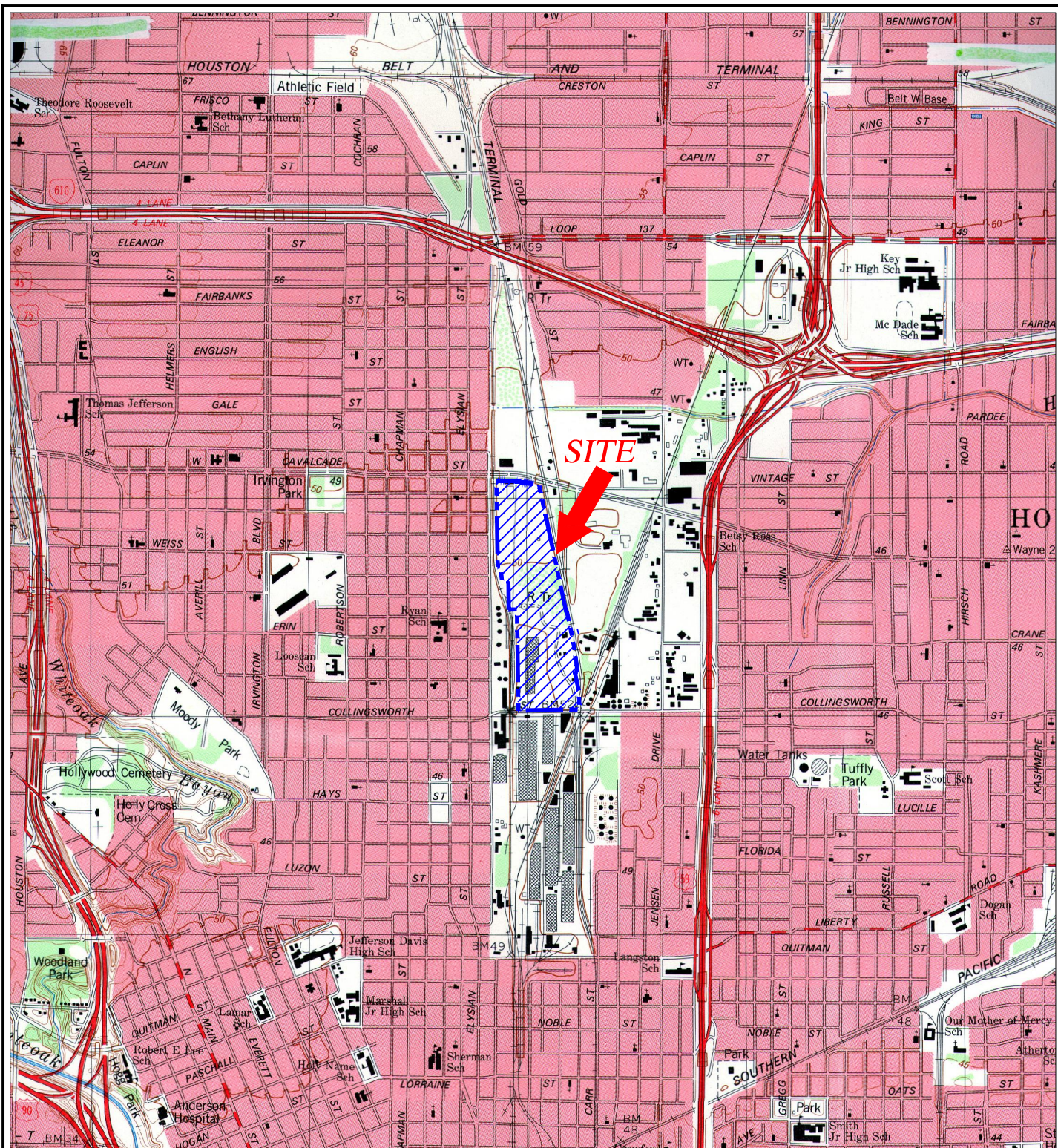
TABLE 2
TASK-SPECIFIC HAZARD ASSESSMENT WITH
PROPOSED INITIAL LEVELS OF PROTECTION
AND AIR MONITORING REQUIREMENTS
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

Task	Chemical Hazard Assessment	Estimated Initial Level of Protection	Air Monitoring
			VOCs
<u>Existing Monitoring Well Search, Inspection and Gauging Activities:</u>			
Locate all on-site and off-site wells	Low	D	NO
Low	Low	D	NO
Measure and record depth readings and DNAPL (if any)	Low	D	NO
<u>Installation and Sampling of Temporary Monitoring Wells</u>			
Install 33 temporary monitoring wells comprised of 15 shallow and intermediate well clusters using direct push techniques (Geoprobe®)	Low	D	YES
Measure depth of wells, water, DNAPL	Low	D	YES
Continuous soil sampling and logging, screen with PID	Low	D	YES
Collection of groundwater samples (purging and sampling with low flow pumps, measure field parameters)	Low	D	YES
Temporary monitoring well abandonment - remove well screen and riser, grout borehole with bentonite, restore to grade with concrete	Low	D	NO
Survey each temporary well location	Low	D	NO
<u>Existing Monitoring Well and Piezometer Sampling</u>			
Measure depth of wells, water, DNAPL	Low	D	YES
Groundwater purging and sampling	Low	D	YES
Equipment decontamination	Low	D	NO
<u>Handling investigation derived waste (IDW)</u>			
Containerize soil cuttings, purge water, and decontamination liquids into 55 gallon steel drums	Low	D	NO
Stage investigative-derived waste (IDW) temporarily on-site and collect a soil sample and a water sample for analysis prior to disposal.	Low	D	NO

Note: Air monitoring with the PID is just checking the wells when they are opened before starting work or checking newly installed wells. Continuous monitoring is not required unless conditions change or an initial positive reading has been obtained.

FIGURES

y:\south_cavalcade\13-665\hsp\figure 1.dwg Last Saved By: Scorer 4/25/2013 3:13 PM Plotted By: Shelly Comer 4/29/2013 2:21 PM Scale: 1:1,0168



QUADRANGLE LOCATION

REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE
OF SETTEGAST, TEXAS - 1982

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

BEAZER EAST, INC
PITTSBURGH, PENNSYLVANIA

DRWN: SCC DATE: 04/23/13
CHKD: BLH DATE: 04/23/13
APPD: JSZ DATE: 04/23/13
SCALE: 1" = 2000'



HASP
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

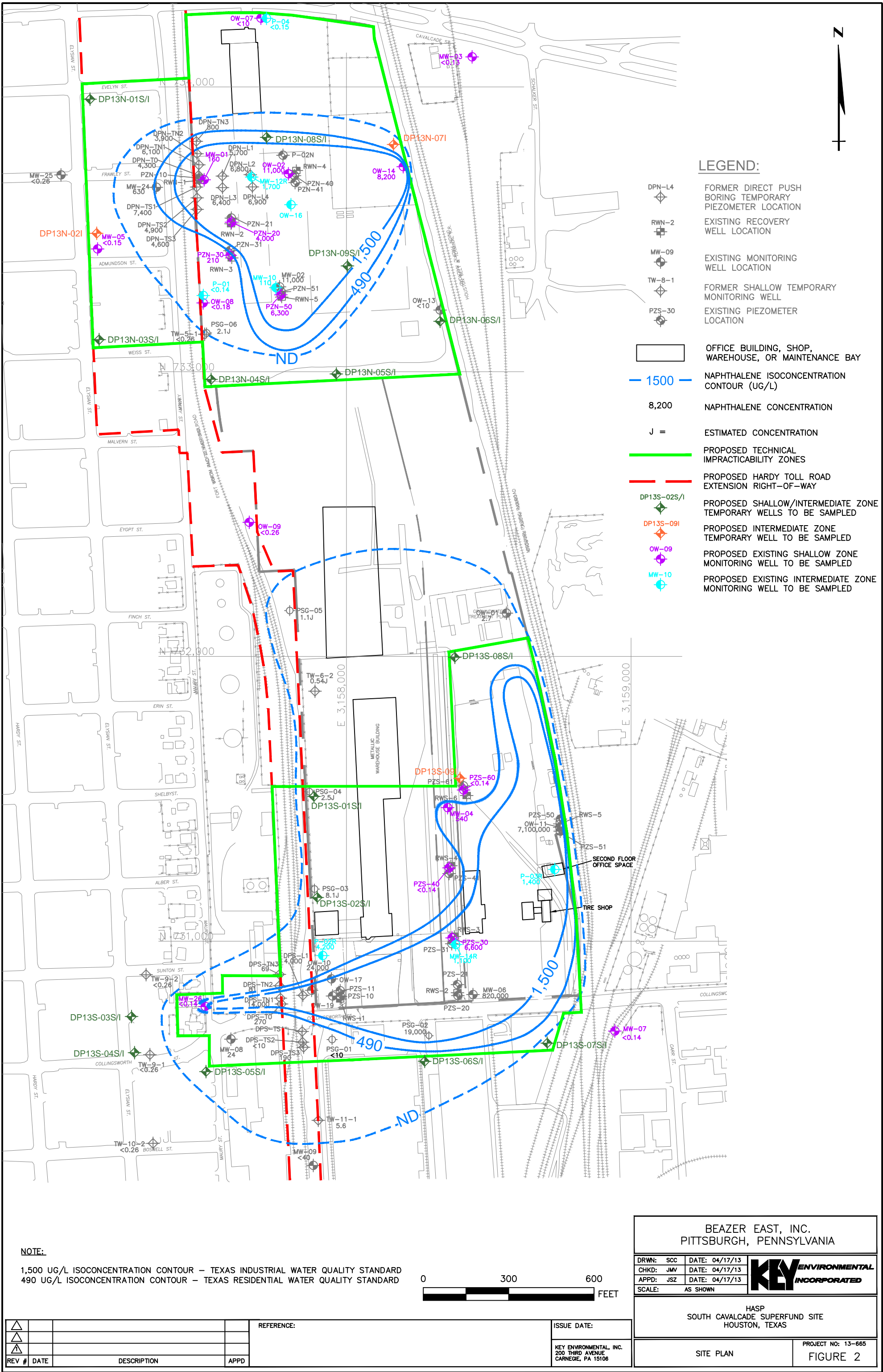
SITE LOCATION MAP

PROJECT NO: 13-665

FIGURE 1

007332

y:\south_cavalcade\13-665\hosp\figure 2.dwg shelly corner 1:1 4/29/2013 2:21 PM



007333

APPENDIX A

**LIST OF HAZARDOUS CHEMICALS
AND
MATERIAL SAFETY DATA SHEETS**

LIST OF HAZARDOUS CHEMICALS
South Cavalcade Superfund Site

Chemical	Container/Amount	Manufacturer /Distributor	Use
Potential Site Constituents:			
Coal Tar Creosote/PAHs	Soil/groundwater	NA	NA
Naphthalene	Soil/groundwater	NA	NA
Benzene	Soil/groundwater	NA	NA
Toluene	Soil/groundwater	NA	NA
Ethylbenzene	Soil/groundwater	NA	NA
Xylene	Soil/groundwater	NA	NA
Chemicals that may be brought on site:			
Alconox liquid/solution			Clean sampling equipment
Acetone			Clean sampling equipment
Isopropyl Alcohol			Clean sampling equipment
Hexane			Clean sampling equipment
Nitric Acid	A few milliliters in sample jars		Sample preservative
Hydrochloric Acid	A few milliliters in sample jars		Sample preservative
Sulfuric Acid	A few milliliters in sample jars		Sample preservative
Zinc Acetate/Sodium Hydroxide Solution (two MSDSs)	A few milliliters in sample jars		Sample preservative
pH 10 Buffer Solution			Water testing
pH 4 Buffer Solution			Water testing
pH 7 Buffer Solution			Water testing
Conductivity Standard			Water testing
Bentonite (example MSDS)			Sealing Wells
Portland Cement (example MSDS)			Sealing Wells

The following Material Safety Data Sheets (MSDSs) are provided for general information on the chemical and physical properties and potential health hazards of constituents that may be present at the Site. The use of manufacturer names does not imply that these products were in fact used at the Site; nor imply or infer any liability on the part of the manufacturer of any product represented, or the preparer of the MSDS.

Material Safety Data Sheet
Coal Tar Distillate
(Recovered Material for Reuse/Recycling)
(Not a Manufactured Product)

Section 1 --- Material Identification

Trade Name: Recovered Coal Tar Distillate for Reuse/Recycling (*Not a manufactured product*)

Synonym: None

Provider: Beazer East, Inc.
One Oxford Centre
Pittsburgh, PA 15219

Emergency Telephone No.: (800) 424-9300

Section 2 --- Composition/Information on Ingredients

Coal tar distillate is a complex mixture of hydrocarbons.

<u>INGREDIENTS</u>	<u>CAS NO.</u>	<u>% by Wt.</u>	<u>OSHA PEL-TWA</u>	<u>ACGIH TLV-TWA</u>
Coal Tar Distillate ¹	65996-92-1	100	0.2 mg/m ³	0.2 mg/m ³
Indene	95-13-6	<10	10 ppm	10 ppm
Naphthalene	91-20-3	<15	10 ppm	10 ppm
Biphenyl	92-52-4	<5	0.2 ppm	0.2 ppm
Benzene	71-43-2	<1	1 ppm	0.5 ppm
Alkyl naphthalene	---	<10	None	None
Phenanthrene	85-01-8	9-13	None	None
Benz(a)anthracene	56-55-3	0.5-2	None	None
Benzo(a)phenanthrene	218-01-9	0.5-2	None	None
Benzo(b)fluoranthene	205-99-2	---	None	None
Benzo(k)fluoranthene	207-08-9	---	None	None
Benzo(j)fluoranthene	205-82-3	---	None	None
7,12-Dimethylbenz(a)anthracene	57-97-6	1-3	None	None
Indeno (1,2,3-cd) pyrene	193-39-5	0.1-0.3	None	None
Benzo(a)pyrene	50-32-8	0.5-2	None	None
Dibenz(a,h)anthracene	53-70-3	0.01-0.1	None	None
Benzo(g,h,i)perylene	191-24-2	---	None	None
7-H Dibenz(o,c,g)carbazole	194-59-2	0.01-0.2	None	None
Dibenzo(a,l)pyrene	191-30-0	0.01-0.1	None	None
1-Nitropyrene	5522-43-0	0.1-0.3	None	None
Dibenz(a,j)acridine	224-42-0	0.01-0.1	None	None
Dibenz(a,h)acridine	226-36-8	0.01-0.1	None	None

Notes:

1 The exposure limit for coal tar pitch volatiles is used as the overall exposure limit for this product.

Section 3 --- Hazard Identification

Emergency overview

CHRONIC OVEREXPOSURE (as defined by OSHA recommended standards) MAY CAUSE CANCER

WARNING

MAY BE FATAL IF SWALLOWED

HARMFUL TO THE SKIN OR IF INHALED

CAUSES EYE AND SKIN IRRITATION

AVOID PROLONGED OR REPEATED CONTACT

OBSERVE GOOD HYGIENE AND SAFETY PRACTICES WHEN HANDLING THIS PRODUCT

DO NOT USE THIS PRODUCT UNTIL MSDS & PRODUCT LABEL HAVE BEEN READ/UNDERSTOOD.

WARNING: THIS PRODUCT CONTAINS A CHEMICAL KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

HMIS Rating: Health - 2, Fire - 1, Reactivity - 0

Potential health Effects

Primary Entry Routes: Inhalation of vapors or mist, eye/skin contact, incidental or inadvertent ingestion.

Target Organs: Respiratory tract, skin, eyes, bladder, kidneys.

Acute (Immediate) Effects

Inhalation: Acute overexposure to vapor may result in respiratory tract irritation. Repeated and/or prolonged contact to high concentrations of vapor may result in respiratory difficulties, central nervous system (CNS) effects characterized by headache, drowsiness, dizziness, weakness, incoordination, circulatory system collapse, coma, and possible death.

Eye: Direct contact with liquid or vapor may cause moderate to severe irritation and burns.

Skin: Skin contact can cause severe irritation, redness, burning, rash and itching which is made worse by exposure to sunlight (photosensitization).

Ingestion: Ingestion of the material may cause gastrointestinal disturbances including irritation, nausea, vomiting, and abdominal pain. Systemic effects are similar to those described under "Inhalation".

Chronic (Long Term Effects)

Effects of long term or repeated exposure to coal tar distillates may include dermatitis, skin cancer and lung cancer.

Carcinogenicity

This material or similar materials has caused cancer in laboratory animals when administered throughout the major part of their lifetime.

The IARC monographs (Vol. 35) lists creosotes from coal tars, coal tars, and coal tar pitch volatiles as Group 1 carcinogens (carcinogenic to humans). The NTP Eleventh Annual Report on Carcinogens lists coal tars and coal tar pitches as Known to be Human Carcinogens.

This product contains benzene. The IARC monographs (vol. 29) lists benzene as a Group 1 carcinogen (carcinogenic to humans). The NTP Eleventh Annual Report on Carcinogens lists benzene as a Known to be Human Carcinogen.

This product contains naphthalene. The IARC monographs (vol. 82) lists naphthalene as Group 2B carcinogen (possibly carcinogenic to humans). Naphthalene is also listed in the NTP Eleventh Annual Report on Carcinogens as Reasonably Anticipated to be a Human Carcinogen.

Section 4 --- First Aid Measures

Inhalation: Move the person to fresh air and support breathing as required. Consult a physician if victim has continued difficulty breathing.

Eye Contact: Lift eyelids and flush immediately with flooding amounts of water for at least 15 minutes. Do not allow the victim to rub his/her eyes or keep them shut. Consult a physician or ophthalmologist if all material cannot be removed or if there is continuing irritation.

Skin Contact: Remove clothing around affected area. Wipe away loose material and wash affected area with soap and water or waterless (non-alcohol) hand cleanser. If there is a severe skin reaction or reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center with information from this MSDS. Unless the poison control center advises otherwise, give the person one or two glasses of water or milk, then induce vomiting. After vomiting, the victim may be given a slurry of 100g. of activated charcoal in 8 oz. of water. Seek medical aid.

Section 5 --- Fire Fighting Measures

Flash Point: >93°C (>200°F)

Autoignition Temperature: Not determined.

Lower Explosive Limit: Not determined.

Upper Explosive Limit: Not determined.

Extinguishing Media: Use dry chemical, carbon dioxide, or foam. Use water spray only if the preferred measures are not available.

Unusual Fire or Explosion Hazards: Vapors may travel to an ignition source and flash back. Containers may explode in heat of fire. Coal tar distillate presents a vapor explosion hazard indoors, outdoors and in sewers. Material is not sensitive to contact or static discharge.

Hazardous Combustion Products: Oxides of carbon and other toxic vapors may be given off in a fire. Thick, black acrid smoke may be generated.

Fire Fighting: Wear a self-contained breathing apparatus (SCBA) with full facepiece operated in the pressure demand or positive pressure mode and full protective clothing. Do not allow runoff from fire fighting to enter roadways or sewers. Use water to cool off containers and structures and to protect personnel.

Section 6 --- Accidental Release Measures

Stop leak if there is no risk involved. Stay upwind of the spill or leak. Wear appropriate protective clothing and respiratory protection for the situation. If the material has solidified shovel into dry containers and cover. For wet spills use sand or noncombustible absorbent material. Collect spilled material and place in sealed containers for reclamation or disposal. Recycle or dispose of material according to local, state, and federal regulations. This product released into the environment must be reported to the National Response Center (1-800-424-8802). When this product is spilled or leaked the reportable quantity is 1 lb. or more).

Section 7 --- Handling and Storage

Handling: Avoid prolonged or repeated breathing of vapors, mists or fumes. Avoid prolonged or repeated contact with skin or eyes. Observe good personal hygiene practices and recommended procedures. Application of certain skin creams (sun screen in conjunction with a general purpose protective cream) before working/several times during work may be beneficial. Wash exposed areas promptly and thoroughly after skin contact from working with this product and before eating, drinking, using tobacco products or rest rooms.

Storage: Store in a closed, labeled container within a cool or well shaded and dry, ventilated area. Protect containers from physical damage. Keep containers closed when not in use. Maintain good housekeeping.

Section 8 --- Exposure Controls and Personal Protection

Engineering Control and Ventilation: Provide sufficient general/local exhaust ventilation in pattern/volume to control inhalation exposures below current exposure limits and areas below flammable vapor concentrations. Local exhaust is necessary for use in enclosed or confined spaces. See OSHA 29 CFR 1910.146 Permit Required Confined Space.

Respiratory Protection: Not required under normal use conditions. If ventilation does not maintain inhalation exposures below the PEL or TLV then wear NIOSH/MSHA approved respirators per the current OSHA respiratory protection standard, 29 CFR 1910.134 and the respirator manufacturer's instructions and warnings. Use NIOSH respiratory protection guidelines to select proper respiratory protection.

Eye Protection: Wear industrial safety glasses with side shields and /or goggles or faceshield as necessary for conditions. Comply with the requirements of OSHA 29 CFR 1910.133.

Skin Protection: Use impervious, chemical resistant gloves when handling. Depending on working conditions, i.e., contact potential, wear chemical resistant protective garments such as head/neck cover, aprons, jackets, coveralls, or long sleeved shirts and long pants, boots, long pants, chemical resistant overshoes, etc.

Section 9 --- Physical and Chemical Properties

Physical State: Liquid.

Appearance/Odor: Brown to black. Tar odor.

Solubility: Slightly soluble in water.

Specific Gravity (H₂O=1): 1.05

Boiling Point: >180°C (>355°F)

Melting Point: NA

Flash Point: >200°F

Vapor Pressure: 1 mm at 30°C

Vapor Density (Air = 1): >1

Evaporation Rate (Ether = 1): slow

Viscosity: ND

pH: ND

Section 10 --- Stability and Reactivity

Stability: Product is stable.

Polymerization: Hazardous polymerization will not occur.

Chemical Incompatibilities: None known.

Conditions to Avoid: Overheating.

Hazardous Decomposition Products: Oxides of carbon and other toxic vapors.

Section 11 --- Disposal Considerations

Dispose of in accordance with local, state, and federal regulations.

Section 12 --- Transport Information

U.S. Department of Transportation (DOT) regulations - 49 Code of Federal Regulations (CFR)

Shipping Name: RQ Environmentally Hazardous Substance, liquid, n.o.s., (Coal Tar Distillate, contains Benzene, Naphthalene)

Label: Class 9

ID No.: NA 3082

Hazard Class: 9

Packing Group: III

Special Provisions: None

Quantity Limitations –

Passenger Aircraft or Railcar: None

Cargo Aircraft Only: None

Vessel Stowage: Area A

Non-Bulk Packaging: See 173.203

Packaging Exceptions: See 173.155

Bulk Packaging: See 173.241

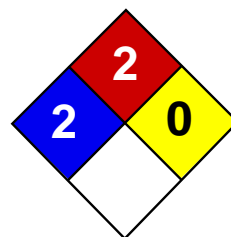
Section 13 --- Regulatory Information

Component	OSHA Hazardous Chemical	CERCLA Reportable Quantity (lbs)	Extremely Hazardous Substance (40 CFR 355)	CAA Section 112 TQ	SARA Section 313
Coal Tar Distillate	YES	1	---	---	---
Indene	YES	---	---	---	---
Naphthalene	YES	100	---	---	YES
Biphenyl	YES	100	---	---	YES
Benzene	YES	10	---	---	YES
Alkyl naphthalene	YES	---	---	---	---
Phenanthrene	YES	5,000	---	---	YES
Benz(a)anthracene	YES	10	---	---	YES*
Benzo(a)phenanthrene	YES	100	---	---	---
Benzo(b)fluoranthene	YES	1	---	---	YES*
Benzo(j)fluoranthene	YES	---	---	---	YES*
Benzo(k)fluoranthene	YES	5,000	---	---	YES*
7,12-Dimethylbenz(a)anthracene	YES	1	---	---	YES*
Indeno(1,2,3-cd)pyrene	YES	100	---	---	YES*
Benzo(a)pyrene	YES	1	---	---	YES*
Dibenz(a,h)anthracene	YES	1	---	---	YES*
Benzo(g,h,i)perylene	YES	10	---	---	YES
7-H Dibenzo(c,g)carbazole	YES	---	---	---	YES*
Dibenzo(a,l)pyrene	YES	---	---	---	YES*
1-Nitropyrene	YES	---	---	---	YES*
Dibenz(a,j)acridine	YES	---	---	---	YES*
Dibenz(a,h)acridine	YES	---	---	---	YES*

* = Polycyclic Aromatic Compounds (PAC) category TRI threshold = 100 lbs.

Section 14 --- Other Information

Prepared by John E. Francis, CIH, CSP
Prepared 9/05, Revision 1 (1/27/06).



Health	2
Fire	2
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Naphthalene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Naphthalene

Catalog Codes: SLN1789, SLN2401

CAS#: 91-20-3

RTECS: QJ0525000

TSCA: TSCA 8(b) inventory: Naphthalene

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: C₁₀H₈

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Naphthalene	91-20-3	100

Toxicological Data on Ingredients: Naphthalene: ORAL (LD50): Acute: 490 mg/kg [Rat]. 533 mg/kg [Mouse]. 1200 mg/kg [Guinea pig]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit]. VAPOR (LC50): Acute: 170 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of ingestion. Hazardous in case of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (irritant, permeator). Severe over-exposure can result in death.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE]. The substance is toxic to blood, kidneys, the nervous system, the reproductive system, liver, mucous membranes, gastrointestinal tract, upper respiratory tract, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 567°C (1052.6°F)

Flash Points: CLOSED CUP: 88°C (190.4°F). OPEN CUP: 79°C (174.2°F).

Flammable Limits: LOWER: 0.9% UPPER: 5.9%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable solid. **SMALL FIRE:** Use DRY chemical powder. **LARGE FIRE:** Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Flammable solid. Stop leak if without risk. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe dust. Avoid contact with eyes Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:

Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

Israel: TWA: 10 (ppm) TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [1995] TWA: 52 STEL: 79 (mg/m3) from ACGIH [1995]
Australia: STEL: 15 (ppm) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Crystalline solid.)

Odor: Aromatic.

Taste: Not available.

Molecular Weight: 128.19 g/mole

Color: White.

pH (1% soln/water): Not available.

Boiling Point: 218°C (424.4°F)

Melting Point: 80.2°C (176.4°F)

Critical Temperature: Not available.

Specific Gravity: 1.162 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: 4.4 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.038 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties:

Partially dispersed in hot water, methanol, n-octanol. Very slightly dispersed in cold water. See solubility in methanol, n-octanol.

Solubility:

Partially soluble in methanol, n-octanol. Very slightly soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Highly reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: May attack some forms of rubber and plastic

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 490 mg/kg [Rat]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 170 ppm 4 hour(s) [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE]. The substance is toxic to blood, kidneys, the nervous system, the reproductive system, liver, mucous membranes, gastrointestinal tract, upper respiratory tract, central nervous system (CNS).

Other Toxic Effects on Humans:

Very hazardous in case of ingestion. Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 305.2 ppm 96 hour(s) [Trout].

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 4.1: Flammable solid.

Identification: : Naphthalene, refined : UN1334 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:

Rhode Island RTK hazardous substances: Naphthalene Pennsylvania RTK: Naphthalene Florida: Naphthalene Minnesota: Naphthalene Massachusetts RTK: Naphthalene TSCA 8(b) inventory: Naphthalene TSCA 8(a) PAIR: Naphthalene TSCA 8(d) H and S data reporting: Naphthalene: 06/01/87 SARA 313 toxic chemical notification and release reporting: Naphthalene: 1% CERCLA: Hazardous substances.: Naphthalene: 100 lbs. (45.36 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS B-4: Flammable solid. CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R36- Irritating to eyes. R40- Possible risks of irreversible effects. R48/22- Harmful: danger of serious damage to health by prolonged exposure if swallowed. R48/23- Toxic: danger of serious damage to health by prolonged exposure through inhalation. R63- Possible risk of harm to the unborn child.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 2

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 2

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

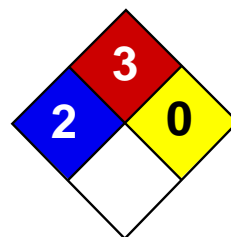
References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 01:30 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Benzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Benzene

Catalog Codes: SLB1564, SLB3055, SLB2881

CAS#: 71-43-2

RTECS: CY1400000

TSCA: TSCA 8(b) inventory: Benzene

CI#: Not available.

Synonym: Benzol; Benzine

Chemical Name: Benzene

Chemical Formula: C₆-H₆

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Benzene	71-43-2	100

Toxicological Data on Ingredients: Benzene: ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse]. DERMAL (LD50): Acute: >9400 mg/kg [Rabbit]. VAPOR (LC50): Acute: 10000 ppm 7 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of eye contact (irritant), of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC. MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE]. The substance is toxic to blood, bone marrow, central nervous system (CNS). The substance may be toxic to liver, Urinary System. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 497.78°C (928°F)

Flash Points: CLOSED CUP: -11.1°C (12°F). (Setaflash)

Flammable Limits: LOWER: 1.2% UPPER: 7.8%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances:

Highly flammable in presence of open flames and sparks, of heat. Slightly flammable to flammable in presence of oxidizing materials. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Explosive in presence of oxidizing materials, of acids.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:

Extremely flammable liquid and vapor. Vapor may cause flash fire. Reacts on contact with iodine heptafluoride gas. Dioxygenyl tetrafluoroborate is as very powerful oxidant. The addition of a small particle to small samples of benzene, at ambient temperature, causes ignition. Contact with sodium peroxide with benzene causes ignition. Benzene ignites in contact with powdered chromic anhydride. Vigorous or incandescent reaction with hydrogen + Raney nickel (above 210 C) and bromine trifluoride.

Special Remarks on Explosion Hazards:

Benzene vapors + chlorine and light causes explosion. Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate. Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion. Interaction

of nitryl perchlorate with benzene gave a slight explosion and flash. The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powerful oxidant. Uncontrolled contact with benzene may cause explosion. Mixtures of peroxomonsulfuric acid with benzene explodes.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:

Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [United States] TWA: 1.6 STEL: 8 (mg/m3) from ACGIH (TLV) [United States] TWA: 0.1 STEL: 1 from NIOSH TWA: 1 STEL: 5 (ppm) from OSHA (PEL) [United States] TWA: 10 (ppm) from OSHA (PEL) [United States] TWA: 3 (ppm) [United Kingdom (UK)] TWA: 1.6 (mg/m3) [United Kingdom (UK)] TWA: 1 (ppm) [Canada] TWA: 3.2 (mg/m3) [Canada] TWA: 0.5 (ppm) [Canada] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor:

Aromatic. Gasoline-like, rather pleasant. (Strong.)

Taste: Not available.

Molecular Weight: 78.11 g/mole

Color: Clear Colorless. Colorless to light yellow.

pH (1% soln/water): Not available.

Boiling Point: 80.1 (176.2°F)

Melting Point: 5.5°C (41.9°F)

Critical Temperature: 288.9°C (552°F)

Specific Gravity: 0.8787 @ 15 C (Water = 1)

Vapor Pressure: 10 kPa (@ 20°C)

Vapor Density: 2.8 (Air = 1)

Volatility: Not available.

Odor Threshold: 4.68 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:

Miscible in alcohol, chloroform, carbon disulfide oils, carbon tetrachloride, glacial acetic acid, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles.

Incompatibility with various substances: Highly reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Benzene vapors + chlorine and light causes explosion. Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate. Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion. Interaction of nitryl perchlorate with benzene gave a slight explosion and flash. The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powerful oxidant. Uncontrolled contact with benzene may cause explosion. Mixtures of peroxomonsulfuric acid with benzene explodes.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 930 mg/kg [Rat]. Acute dermal toxicity (LD50): >9400 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 10000 7 hours [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC. **MUTAGENIC EFFECTS:** Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. **DEVELOPMENTAL TOXICITY:** Classified Reproductive system/toxin/female [POSSIBLE]. Causes damage to the following organs: blood, bone marrow, central nervous system (CNS). May cause damage to the following organs: liver, Urinary System.

Other Toxic Effects on Humans:

Very hazardous in case of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects (female fertility, Embryotoxic and/or foetotoxic in animal) and birth defects. May affect genetic material (mutagenic). May cause cancer (tumorigenic, leukemia)) Human: passes the placental barrier, detected in maternal milk.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Causes skin irritation. It can be absorbed through intact skin and affect the liver, blood, metabolism, and urinary system. Eyes: Causes eye irritation. Inhalation: Causes respiratory tract and mucous membrane irritation. Can be absorbed through the lungs. May affect behavior/Central and Peripheral nervous systems (somnolence, muscle weakness, general anesthetic, and other symptoms similar to ingestion), gastrointestinal tract (nausea), blood metabolism, urinary system. Ingestion: May be harmful if swallowed. May cause gastrointestinal tract irritation including vomiting. May affect behavior/Central and Peripheral nervous systems (convulsions, seizures, tremor, irritability, initial CNS stimulation followed by depression, loss of coordination, dizziness, headache, weakness, pallor, flushing), respiration (breathlessness and chest constriction), cardiovascular system, (shallow/rapid pulse), and blood.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Benzene UNNA: 1114 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Benzene California prop. 65 (no significant risk level): Benzene: 0.007 mg/day (value) California prop. 65: This product contains the following ingredients

for which the State of California has found to cause cancer which would require a warning under the statute: Benzene Connecticut carcinogen reporting list.: Benzene Connecticut hazardous material survey.: Benzene Illinois toxic substances disclosure to employee act: Benzene Illinois chemical safety act: Benzene New York release reporting list: Benzene Rhode Island RTK hazardous substances: Benzene Pennsylvania RTK: Benzene Minnesota: Benzene Michigan critical material: Benzene Massachusetts RTK: Benzene Massachusetts spill list: Benzene New Jersey: Benzene New Jersey spill list: Benzene Louisiana spill reporting: Benzene California Director's list of Hazardous Substances: Benzene TSCA 8(b) inventory: Benzene SARA 313 toxic chemical notification and release reporting: Benzene CERCLA: Hazardous substances.: Benzene: 10 lbs. (4.536 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R11- Highly flammable. R22- Harmful if swallowed. R38- Irritating to skin. R41- Risk of serious damage to eyes. R45- May cause cancer. R62- Possible risk of impaired fertility. S2- Keep out of the reach of children. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S39- Wear eye/face protection. S46- If swallowed, seek medical advice immediately and show this container or label. S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

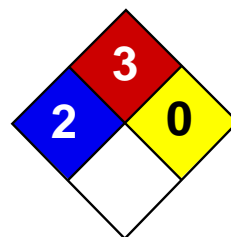
References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:35 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Ethylbenzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Ethylbenzene

Catalog Codes: SLE2044

CAS#: 100-41-4

RTECS: DA0700000

TSCA: TSCA 8(b) inventory: Ethylbenzene

CI#: Not available.

Synonym: Ethyl Benzene; Ethylbenzol; Phenylethane

Chemical Name: Ethylbenzene

Chemical Formula: C₈H₁₀

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Ethylbenzene	100-41-4	100

Toxicological Data on Ingredients: Ethylbenzene: ORAL (LD₅₀): Acute: 3500 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (irritant, sensitizer). **CARCINOGENIC EFFECTS:** Classified 2B (Possible for human.) by IARC. **MUTAGENIC EFFECTS:** Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Not available. The substance may be toxic to central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 432°C (809.6°F)

Flash Points:

CLOSED CUP: 15°C (59°F). (Tagliabue.) OPEN CUP: 26.667°C (80°F) (Cleveland) (CHRIS, 2001) CLOSED CUP: 12.8 C (55 F) (Bingham et al, 2001; NIOSH, 2001) CLOSED CUP: 21 C (70 F) (NFPA)

Flammable Limits: LOWER: 0.8% - 1.6%UPPER: 6.7% - 7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive in presence of heat.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:

Vapor may travel considerable distance to source of ignition and flash back. Vapors may form explosive mixtures with air. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Vapors may form explosive mixtures in air.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:

Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Sensitive to light. Store in light-resistant containers.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [United States] TWA: 435 STEL: 545 from OSHA (PEL) [United States] TWA: 435 STEL: 545 (mg/m3) from NIOSH [United States] TWA: 100 STEL: 125 (ppm) from NIOSH [United States] TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) [United States] TWA: 100 STEL: 125 (ppm) [United Kingdom (UK)] TWA: 100 STEL: 125 (ppm) [Belgium] TWA: 100 STEL: 125 (ppm) [Finland] TWA: 50 (ppm) [Norway] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweetish. Gasoline-like. Aromatic.

Taste: Not available.

Molecular Weight: 106.16 g/mole

Color: Colorless.

pH (1% soln/water): Not available.

Boiling Point: 136°C (276.8°F)

Melting Point: -94.9 (-138.8°F)

Critical Temperature: 617.15°C (1142.9°F)

Specific Gravity: 0.867 (Water = 1)

Vapor Pressure: 0.9 kPa (@ 20°C)

Vapor Density: 3.66 (Air = 1)

Volatility: 100% (v/v).

Odor Threshold: 140 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; $\log(\text{oil/water}) = 3.1$

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility:

Easily soluble in diethyl ether. Very slightly soluble in cold water or practically insoluble in water. Soluble in all proportions in Ethyl alcohol. Soluble in Carbon tetrachloride, Benzene. Insoluble in Ammonia. Slightly soluble in Chloroform. Solubility in Water: 169 mg/l @ 25 deg. C.; 0.014 g/100 ml @ 15 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources (flames, sparks, static), incompatible materials, light

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity:

Can react vigorously with oxidizing materials. Sensitive to light.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation.

Toxicity to Animals: Acute oral toxicity (LD50): 3500 mg/kg [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. May cause damage to the following organs: central nervous system (CNS).

Other Toxic Effects on Humans:

Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).

Special Remarks on Toxicity to Animals:

Lethal Dose/Conc 50% Kill: LD50 [Rabbit] - Route: Skin; Dose: 17800 ul/kg Lowest Published Lethal Dose/Conc: LDL[Rat] - Route: Inhalation (vapor); Dose: 4000 ppm/4 H

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects and birth defects (teratogenic) based on animal test data. May cause cancer based on animals data. IARC evidence for carcinogenicity in animals is sufficient. IARC evidence of carcinogenicity in humans inadequate. May affect genetic material (mutagenic).

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Can cause mild skin irritation. It can be absorbed through intact skin. Eyes: Contact with vapor or liquid can cause severe eye irritation depending on concentration. It may also cause conjunctivitis. At a vapor exposure level of 85 - 200 ppm, it is mildly and transiently irritating to the eyes; 1000 ppm causes further irritation and tearing; 2000 ppm results in immediate and severe irritation and tearing; 5,000 ppm is intolerable (ACGIH, 1991; Clayton and Clayton, 1994). Standard draize test for eye irritation using 500 mg resulted in severe irritation (RTECS) Inhalation: Exposure to high concentrations can cause nasal, mucous membrane and respiratory tract irritation and can also result in chest constriction and, trouble breathing, respiratory failure, and even death. It can also affect behavior/Central Nervous System. The effective dose for CNS depression in experimental animals was 10,000 ppm (ACGIH, 1991). Symptoms of CNS depression include

headache, nausea, weakness, dizziness, vertigo, irritability, fatigue, lightheadedness, sleepiness, tremor, loss of coordination, judgement and consciousness, coma, and death. It can also cause pulmonary edema. Inhalation of 85 ppm can produce fatigue, insomnia, headache, and mild irritation of the respiratory tract (Haley & Berndt, 1987). Ingestion: Do not drink, pipet or siphon by mouth. May cause gastrointestinal/digestive tract irritation with Abdominal pain, nausea, vomiting. Ethylbenzene is a pulmonary aspiration hazard. Pulmonary aspiration of even small amounts of the liquid may cause fatal pneumonitis. It may also affect behavior/central nervous system with

Section 12: Ecological Information

Ecotoxicity:

Ecotoxicity in water (LC50): 14 mg/l 96 hours [Fish (Trout)] (static). 12.1 mg/l 96 hours [Fish (Fathead Minnow)] (flow-through). 150 mg/l 96 hours [Fish (Blue Gill/Sunfish)] (static). 275 mg/l 96 hours [Fish (Sheepshead Minnow)]. 42.3 mg/l 96 hours [Fish (Fathead Minnow)](soft water). 87.6mg/l 96 hours [Shrimp].

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Ethylbenzene UNNA: 1175 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Connecticut hazardous material survey.: Ethylbenzene Illinois toxic substances disclosure to employee act: Ethylbenzene Illinois chemical safety act: Ethylbenzene New York release reporting list: Ethylbenzene Rhode Island RTK hazardous substances: Ethylbenzene Pennsylvania RTK: Ethylbenzene Minnesota: Ethylbenzene Massachusetts RTK: Ethylbenzene Massachusetts spill list: Ethylbenzene New Jersey: Ethylbenzene New Jersey spill list: Ethylbenzene Louisiana spill reporting: Ethylbenzene California Director's List of Hazardous Substances: Ethylbenzene TSCA 8(b) inventory: Ethylbenzene TSCA 4(a) proposed test rules: Ethylbenzene TSCA 8(d) H and S data reporting: Ethylbenzene: Effective Date: 6/19/87; Sunset Date: 6/19/97 SARA 313 toxic chemical notification and release reporting: Ethylbenzene

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASSE D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R11- Highly flammable. R20- Harmful by inhalation. S16- Keep away from sources of ignition - No smoking. S24/25- Avoid contact with skin and eyes. S29- Do not empty into drains.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information**References:**

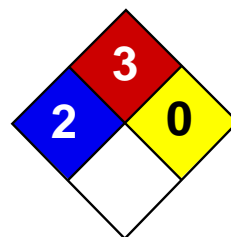
-Manufacturer's Material Safety Data Sheet. -Fire Protection Guide to Hazardous Materials, 13th ed., National Fire Protection Association (NFPA) -Registry of Toxic Effects of Chemical Substances (RTECS) -Chemical Hazard Response Information System (CHRIS) -Hazardous Substance Data Bank (HSDB) -New Jersey Hazardous Substance Fact Sheet -Ariel Global View -Reprotext System

Other Special Considerations: Not available.

Created: 10/09/2005 05:28 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet Toluene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Toluene

Catalog Codes: SLT2857, SLT3277

CAS#: 108-88-3

RTECS: XS5250000

TSCA: TSCA 8(b) inventory: Toluene

CI#: Not available.

Synonym: Toluol, Tolu-Sol; Methylbenzene; Methacide; Phenylmethane; Methylbenzol

Chemical Name: Toluene

Chemical Formula: C₆H₅CH₃ or C₇H₈

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Toluene	108-88-3	100

Toxicological Data on Ingredients: Toluene: ORAL (LD50): Acute: 636 mg/kg [Rat]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit]. VAPOR (LC50): Acute: 49000 mg/m 4 hours [Rat]. 440 ppm 24 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.

MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, the nervous system, liver, brain, central nervous system (CNS).

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: CLOSED CUP: 4.4444°C (40°F). (Setaflash) OPEN CUP: 16°C (60.8°F).

Flammable Limits: LOWER: 1.1% UPPER: 7.1%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances:

Flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable liquid, insoluble in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards:

Toluene forms explosive reaction with 1,3-dichloro-5,5-dimethyl-2,4-imidazolididione; dinitrogen tetroxide; concentrated nitric acid, sulfuric acid + nitric acid; N₂O₄; AgClO₄; BrF₃; Uranium hexafluoride; sulfur dichloride. Also forms an explosive mixture with tetranitromethane.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Toxic flammable liquid, insoluble or very slightly soluble in water. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage**Precautions:**

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.

Storage:

Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection**Engineering Controls:**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 200 STEL: 500 CEIL: 300 (ppm) from OSHA (PEL) [United States] TWA: 50 (ppm) from ACGIH (TLV) [United States] SKIN TWA: 100 STEL: 150 from NIOSH [United States] TWA: 375 STEL: 560 (mg/m3) from NIOSH [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweet, pungent, Benzene-like.

Taste: Not available.

Molecular Weight: 92.14 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 110.6°C (231.1°F)

Melting Point: -95°C (-139°F)

Critical Temperature: 318.6°C (605.5°F)

Specific Gravity: 0.8636 (Water = 1)

Vapor Pressure: 3.8 kPa (@ 25°C)

Vapor Density: 3.1 (Air = 1)

Volatility: Not available.

Odor Threshold: 1.6 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; $\log(\text{oil/water}) = 2.7$

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:

Soluble in diethyl ether, acetone. Practically insoluble in cold water. Soluble in ethanol, benzene, chloroform, glacial acetic acid, carbon disulfide. Solubility in water: 0.561 g/l @ 25 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources (flames, sparks, static), incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Incompatible with strong oxidizers, silver perchlorate, sodium difluoride, Tetranitromethane, Uranium Hexafluoride. Frozen Bromine Trifluoride reacts violently with Toluene at -80 deg. C. Reacts chemically with nitrogen oxides, or halogens to form nitrotoluene, nitrobenzene, and nitrophenol and halogenated products, respectively.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 636 mg/kg [Rat]. Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 440 24 hours [Mouse].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. May cause damage to the following organs: blood, kidneys, the nervous system, liver, brain, central nervous system (CNS).

Other Toxic Effects on Humans:

Hazardous in case of skin contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals:

Lowest Published Lethal Dose: LDL [Human] - Route: Oral; Dose: 50 mg/kg LCL [Rabbit] - Route: Inhalation; Dose: 55000 ppm/40min

Special Remarks on Chronic Effects on Humans:

Detected in maternal milk in human. Passes through the placental barrier in human. Embryotoxic and/or foetotoxic in animal. May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic)

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Causes mild to moderate skin irritation. It can be absorbed to some extent through the skin. Eyes: Causes mild to moderate eye irritation with a burning sensation. Splash contact with eyes also causes conjunctivitis, blepharospasm, corneal edema, corneal abrasions. This usually resolves in 2 days. Inhalation: Inhalation of vapor may cause respiratory tract irritation causing coughing and wheezing, and nasal discharge. Inhalation of high concentrations may affect behavior and cause central nervous system effects characterized by nausea, headache, dizziness, tremors, restlessness, lightheadedness, exhilaration, memory loss, insomnia, impaired reaction time, drowsiness, ataxia, hallucinations, somnolence, muscle contraction or spasticity, unconsciousness and coma. Inhalation of high concentration of vapor may also affect the cardiovascular system (rapid heart beat, heart palpitations, increased or decreased blood pressure, dysrhythmia,), respiration (acute pulmonary edema, respiratory depression, apnea, asphyxia), cause vision disturbances and dilated pupils, and cause loss of appetite. Ingestion: Aspiration hazard. Aspiration of Toluene into the lungs may cause chemical pneumonitis. May cause irritation of the digestive tract with nausea, vomiting, pain. May have effects similar to that of acute inhalation. Chronic Potential Health Effects: Inhalation and Ingestion: Prolonged or repeated exposure via inhalation may cause central nervous system and cardiovascular symptoms similar to that of acute inhalation and ingestion as well liver damage/failure, kidney damage/failure (with hematuria, proteinuria, oliguria, renal tubular acidosis), brain damage, weight loss, blood (pigmented or nucleated red blood cells, changes in white blood cell count), bone marrow changes, electrolyte imbalances (Hypokalemia, Hypophosphatemia), severe, muscle weakness and Rhabdomyolysis. Skin: Repeated or prolonged skin contact may cause defatting dermatitis.

Section 12: Ecological Information

Ecotoxicity:

Ecotoxicity in water (LC50): 313 mg/l 48 hours [Daphnia (daphnia)]. 17 mg/l 24 hours [Fish (Blue Gill)]. 13 mg/l 96 hours [Fish (Blue Gill)]. 56 mg/l 24 hours [Fish (Fathead minnow)]. 34 mg/l 96 hours [Fish (Fathead minnow)]. 56.8 ppm any hours [Fish (Goldfish)].

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Toluene UNNA: 1294 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Toluene California prop. 65 (no significant risk level): Toluene: 7 mg/day (value) California prop. 65 (acceptable daily intake level): Toluene: 7 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Toluene Connecticut hazardous material survey.: Toluene Illinois

toxic substances disclosure to employee act: Toluene Illinois chemical safety act: Toluene New York release reporting list: Toluene Rhode Island RTK hazardous substances: Toluene Pennsylvania RTK: Toluene Florida: Toluene Minnesota: Toluene Michigan critical material: Toluene Massachusetts RTK: Toluene Massachusetts spill list: Toluene New Jersey: Toluene New Jersey spill list: Toluene Louisiana spill reporting: Toluene California Director's List of Hazardous Substances.: Toluene TSCA 8(b) inventory: Toluene TSCA 8(d) H and S data reporting: Toluene: Effective date: 10/04/82; Sunset Date: 10/0/92 SARA 313 toxic chemical notification and release reporting: Toluene CERCLA: Hazardous substances.: Toluene: 1000 lbs. (453.6 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R11- Highly flammable. R20- Harmful by inhalation. S16- Keep away from sources of ignition - No smoking. S25- Avoid contact with eyes. S29- Do not empty into drains. S33- Take precautionary measures against static discharges.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

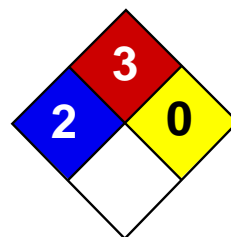
References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:30 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Xylenes MSDS

Section 1: Chemical Product and Company Identification

Product Name: Xylenes

Catalog Codes: SLX1075, SLX1129, SLX1042, SLX1096

CAS#: 1330-20-7

RTECS: ZE2100000

TSCA: TSCA 8(b) inventory: Xylenes

CI#: Not available.

Synonym: Xylenes; Dimethylbenzene; xylol; methyltoluene

Chemical Name: Xylenes (o-, m-, p- isomers)

Chemical Formula: C₆H₄(CH₃)₂

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Xylenes	1330-20-7	100

Toxicological Data on Ingredients: Xylenes: ORAL (LD50): Acute: 4300 mg/kg [Rat]. 2119 mg/kg [Mouse]. DERMAL (LD50): Acute: >1700 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: 3 (Not classifiable for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, liver, mucous membranes, bone marrow, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 464°C (867.2°F)

Flash Points: CLOSED CUP: 24°C (75.2°F). (Tagliabue.) OPEN CUP: 37.8°C (100°F).

Flammable Limits: LOWER: 1% UPPER: 7%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances:

Highly flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Slightly explosive in presence of open flames and sparks, of heat.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Vapors may travel to source of ignition and flash back.

Special Remarks on Explosion Hazards:

Vapors may form explosive mixtures with air. Containers may explode when heated. May polymerize explosively when heated. An attempt to chlorinate xylene with 1,3-Dichloro-5,5-dimethyl-2,4-imidazolidindione (dichlorohydrantoin) caused a violent explosion

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined

areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:

Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 100 (ppm) [Canada] TWA: 435 (mg/m³) [Canada] TWA: 434 STEL: 651 (mg/m³) from ACGIH (TLV) [United States]
TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweetish.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless. Clear

pH (1% soln/water): Not available.

Boiling Point: 138.5°C (281.3°F)

Melting Point: -47.4°C (-53.3°F)

Critical Temperature: Not available.

Specific Gravity: 0.864 (Water = 1)

Vapor Pressure: 0.9 kPa (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 1 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; $\log(\text{oil/water}) = 3.1$

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Insoluble in cold water, hot water. Miscible with absolute alcohol, ether, and many other organic liquids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles

Incompatibility with various substances: Reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Store away from acetic acid, nitric acid, chlorine, bromine, and fluorine.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2119 mg/kg [Mouse]. Acute dermal toxicity (LD50): >1700 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 5000 4 hours [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: 3 (Not classifiable for human.) by IARC. May cause damage to the following organs: blood, kidneys, liver, mucous membranes, bone marrow, central nervous system (CNS).

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals:

Lowest Lethal Dose: LDL [Human] - Route: Oral; Dose: 50 mg/kg LCL [Man] - Route: Oral; Dose: 10000 ppm/6H

Special Remarks on Chronic Effects on Humans:

Detected in maternal milk in human. Passes through the placental barrier in animal. Embryotoxic and/or foetotoxic in animal. May cause adverse reproductive effects (male and female fertility (spontaneous abortion and fetotoxicity)) and birth defects based animal data.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Causes skin irritation. Can be absorbed through skin. Eyes: Causes eye irritation. Inhalation: Vapor causes respiratory tract and mucous membrane irritation. May affect central nervous system and behavior (General anesthetic/CNS depressant with effects including headache, weakness, memory loss, irritability, dizziness, giddiness, loss of coordination and judgement, respiratory depression/arrest or difficulty breathing, loss of appetite, nausea, vomiting, shivering, and possible coma and death). May also affects blood, sense organs, liver, and peripheral nerves. Ingestion: May cause gastrointestinal irritation including abdominal pain, vomiting, and nausea. May also affect liver and urinary system/kidneys. May cause effects similar to those of acute inhalation. Chronic Potential Health Effects: Chronic inhalation may affect the urinary system (kidneys) blood (anemia), bone marrow (hyperplasia of bone marrow) brain/behavior/Central Nervous system. Chronic inhalation may also cause mucosal bleeding. Chronic ingestion may affect the liver and metabolism (loss of appetite) and may affect urinary system (kidney damage)

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Xylenes UNNA: 1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Connecticut hazardous material survey.: Xylenes Illinois chemical safety act: Xylenes New York acutely hazardous substances: Xylenes Rhode Island RTK hazardous substances: Xylenes Pennsylvania RTK: Xylenes Minnesota: Xylenes Michigan critical material: Xylenes Massachusetts RTK: Xylenes Massachusetts spill list: Xylenes New Jersey: Xylenes New Jersey spill list: Xylenes Louisiana spill reporting: Xylenes California Director's List of Hazardous Substances: Xylenes TSCA 8(b) inventory: Xylenes SARA 302/304/311/312 hazardous chemicals: Xylenes SARA 313 toxic chemical notification and release reporting: Xylenes CERCLA: Hazardous substances.: Xylenes: 100 lbs. (45.36 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R10- Flammable. R21- Harmful in contact with skin. R36/38- Irritating to eyes and skin. S2- Keep out of the reach of children. S36/37- Wear suitable protective clothing and gloves. S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

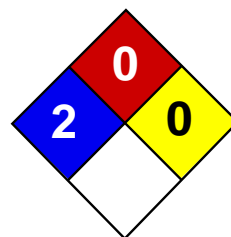
References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 12:54 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.



Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Bentonite MSDS

Section 1: Chemical Product and Company Identification

Product Name: Bentonite

Catalog Codes: SLB1441, SLB2935, SLB4435

CAS#: 1302-78-9

RTECS: CT9450000

TSCA: TSCA 8(b) inventory: Bentonite

CI#: Not applicable.

Synonym: Montmorillonite;

Chemical Name: Not available.

Chemical Formula:

(Al,Fe1.67Mg.33)Si10(OH)2Na(+)Ca(++)/2.33

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Bentonite	1302-78-9	100

Toxicological Data on Ingredients: Bentonite LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (irritant), of ingestion.

Potential Chronic Health Effects:

Hazardous in case of inhalation. CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs.

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Do not breathe dust. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 10 from ACGIH (TLV) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Odorless.

Taste: Not available.

Molecular Weight: Not available.

Color: Beige. (Light.)

pH (1% soln/water): Not available.

Boiling Point: Not available.

Melting Point: Decomposes.

Critical Temperature: Not available.

Specific Gravity: 2.5 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Very slightly soluble in cold water, hot water. Insoluble in methanol, diethyl ether, n-octanol, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Not available.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation.

Toxicity to Animals:

LD50: Not available. LC50: Not available.

Chronic Effects on Humans: Causes damage to the following organs: lungs.

Other Toxic Effects on Humans:

Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant), of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: TSCA 8(b) inventory: Bentonite

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC): R36- Irritating to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:14 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

MATERIAL SAFETY DATA SHEET (MSDS) FOR PORTLAND CEMENT

(Complies with OSHA and MSHA Hazard Communication Standards,
29 CFR 1910.1200 and 30 CFR Part 47)



**CEMEX, INC.
CEMEX CALIFORNIA CEMENT LLC
VICTORVILLE CEMENT PLANT
16888 NORTH "E" STREET
VICTORVILLE, CALIFORNIA 92394-2999**

Section 1 - IDENTIFICATION

Supplier/Manufacturer

CEMEX, Inc.
CEMEX California Cement LLC
Victorville Cement Plant
16888 North "E" Street
Victorville, California 92394-2999

Emergency Contact Information

(619) 381-7600

Chemical name and synonyms

Portland Cement (CAS #65997-15-1)

Product name

"CEMEX Type I/II"
"CEMEX Type III"
"CEMEX Type II/V"
"CEMEX Type V"
"CEMEX Block"
"CEMEX Class G"

Chemical family

Calcium salts.

Formula

3CaO.SiO ₂	(CAS #12168-85-3)
2CaO.SiO ₂	(CAS #10034-77-2)
3CaO.Al ₂ O ₃	(CAS #12042-78-3)
4CaO..Al ₂ O ₃ Fe ₂ O ₃	(CAS #12068-35-8)
CaSO ₂ .2H ₂ O	(CAS #13397-24-5)

Other salts:

Small amounts of MgO, and trace amounts of K₂SO₄ and Na₂SO₄ may also be present.

Section 2 - COMPONENTS

Hazardous Ingredients

Portland cement clinker (CAS# 65997-15- 1) - approximately - 93.5-96.0 % by weight

ACGIH TLV-TWA (2000) = 10 mg total dust/m³

OSHA PEL (8-hour TWA) = 50 million particles/ft³

Gypsum (CAS# 7778-18-9) - approximately - 4.0-6.5 % by weight

ACGIH TLV-TWA (2000) = 10 mg total dust/m³

OSHA PEL (8-hour TWA) = 15 mg total dust/m³

OSHA PEL (8-hour TWA) = 5 mg respirable dust/m³

Respirable quartz (CAS# 14808-60-7) – greater than 0.1% by weight

ACGIH TLV-TWA (2000) = 0.05 mg respirable quartz dust/m³

OSHA PEL (8-hour TWA) = (10 mg respirable dust/m³)/(percent silica + 2)

Trace Ingredients

Trace amounts of naturally occurring chemicals might be detected during chemical analysis. Trace constituents may include up to 0.75% insoluble residue, some of which may be free crystalline silica, calcium oxide (Also known as lime or quick lime), magnesium oxide, potassium sulfate, sodium sulfate, chromium compounds, and nickel compounds.

Section 3 - HAZARD IDENTIFICATION

Emergency Overview

Portland cement is a light gray powder that poses little immediate hazard. A single short-term exposure to the dry powder is not likely to cause serious harm. However, exposure of sufficient duration to wet portland cement can cause serious, potentially irreversible tissue (skin or eye) destruction in the form of chemical (caustic) burns. The same type of tissue destruction can occur if wet or moist areas of the body are exposed for sufficient duration to dry portland cement.

Potential Health Effects

Relevant Routes of Exposure:

Eye contact, skin contact, inhalation, and ingestion.

Effects Resulting from Eye Contact:

Exposure to airborne dust may cause immediate or delayed irritation or inflammation. Eye contact by large amounts of dry powder or splashes of wet portland cement may cause effects ranging from moderate eye irritation to chemical burns or blindness. Such exposures require immediate first aid (see Section 4) and medical attention to prevent significant damage to the eye.

Effects Resulting from Skin Contact:

Discomfort or pain cannot be relied upon to alert a person to hazardous skin exposure. Consequently, the only effective means of avoiding skin injury or illness involves minimizing skin contact, particularly with wet cement. Exposed persons may not feel discomfort until hours after the exposure has ended and significant injury has occurred.

Dry portland cement contacting wet skin or exposure to moist or wet portland cement may cause more severe skin effects including thickening, cracking or fissuring of the skin. Prolonged exposure can cause severe skin damage in the form of (alkali) chemical burns.

Some individuals may exhibit an allergic response upon exposure to portland cement, possibly due to trace elements of chromium. The response may appear in a variety of forms ranging from a mild rash to severe skin ulcers. Persons already sensitized may react to their first contact with the product. Other persons may first experience this effect after years of contact with portland cement products.

Effects Resulting from Inhalation:

Portland cement may contain trace amounts of free crystalline silica. Prolonged exposure to respirable free silica can aggravate other lung conditions and cause silicosis, a disabling and potentially fatal lung disease.

Exposure to portland cement may cause irritation to the moist mucous membranes of the nose, throat, and upper respiratory system. It may also leave unpleasant deposits in the nose.

Effects Resulting from Ingestion:

Although small quantities of dust are not known to be harmful, ill effects are possible if larger quantities are consumed. Portland cement should not be eaten.

Carcinogenic potential:

Portland cement is **not** listed as a carcinogen by NTP, OSHA, or IARC. It may however, contain trace amounts of substances listed as carcinogens by these organizations.

Crystalline silica, a potential trace level contaminate in Portland cement, is now classified by IARC as known human carcinogen (Group I). NTP has characterized respirable silica as "reasonably anticipated to be [a] carcinogen".

Medical conditions which may be aggravated by, inhalation or dermal exposure:

Pre-existing upper respiratory and lung diseases.

Unusual (hyper) sensitivity to hexavalent chromium (chromium⁺⁶) salts.

Section 4 - FIRST AID

Eyes

Immediately flush eyes thoroughly with water. Continue flushing eye for at least 15 minutes, including under lids, to remove all particles. Call physician immediately.

Skin

Wash skin with cool water and pH-neutral soap or a mild detergent. Seek medical treatment in all cases of prolonged exposure to wet cement, cement mixtures, liquids from fresh cement products, or prolonged wet skin exposure to dry cement.

Inhalation of Airborne Dust

Remove to fresh air. Seek medical help if coughing and other symptoms do not subside.

Ingestion

Do not induce vomiting. If conscious, have the victim drink plenty of water and call a physician immediately.

Section 5 - FIRE AND EXPLOSION DATA

Flash point	None	Lower Explosive Limit.....	None
Upper Explosive Limit.....	None	Auto ignition temperature.....	Not Combustible
Extinguishing media.....	Not Combustible	Special fire fighting Procedures.....	None
Hazardous combustion products.....	None	Unusual fire and explosion hazards...	None

Section 6 - ACCIDENTAL RELEASE MEASURES

Collect dry material using a scoop. Avoid actions that cause dust to become airborne. Avoid inhalation of dust and contact with skin. Wear appropriate personal protective equipment as described in Section 8.

Scrape up wet material and place in an appropriate container. Allow the material to "dry" before disposal. Do not attempt to wash portland cement down drains.

Dispose of waste material according to local, state and federal regulations.

Section 7 - HANDLING AND STORAGE

Keep portland cement dry until used. Normal temperatures and pressures do not affect the material.

Promptly remove dusty clothing or clothing which is wet with cement fluids and launder before reuse. Wash thoroughly after exposure to dust or wet cement mixtures or fluids.

Section 8 - EXPOSURE CONTROLS/PERSONAL PROTECTION

Skin Protection

Prevention is essential to avoiding potentially severe skin injury. Avoid contact with unhardened portland cement. If contact occurs, promptly wash affected area with soap and water. Where prolonged exposure to unhardened portland cement products might occur, wear impervious clothing and gloves to eliminate skin contact. Wear sturdy boots that are impervious to water to eliminate foot and ankle exposure.

Do not rely on barrier creams: barrier creams should not be used in place of gloves.

Periodically wash areas contacted by dry portland cement or by wet cement or concrete fluids with a pH neutral soap. Wash again at the end of work. If irritation occurs, immediately wash the affected area and seek treatment. If clothing becomes saturated with wet concrete, it should be removed and replaced with clean dry clothing.

Respiratory Protection

Avoid actions that cause dust to become airborne. Use local or general exhaust ventilation to control exposures below applicable exposure limits.

Use NIOSH/MSHA approved (under 30 CFR 11) or NIOSH approved (under 42 CFR 84) respirators in poorly ventilated areas, if an applicable exposure limit is exceeded, or when dust causes discomfort or irritation. (Advisory: Respirators and filters purchased after June 10, 1998 must be certified under 42 CFR 84.)

Ventilation

Use local exhaust or general dilution ventilation to control exposure within applicable limits.

Eye Protection

Where potentially subject to splashes or puffs of cement, wear safety glasses with side shields or goggles. In extremely dusty environments and unpredictable environments wear unvented or indirectly vented goggles to avoid eye irritation or injury. Contact lenses should not be worn when working with portland cement or fresh cement products.

Section 9 - PHYSICAL AND CHEMICAL, PROPERTIES

Appearance.....	Gray Powder	Odor.....	No distinct odor
Physical state.....	Solid (powder)	pH (in water).....	12 to 13
Solubility in water...	Slightly soluble (0.1 to 1.0%)	Vapor pressure.....	Not applicable
Vapor density.....	Not applicable	Boiling point.....	Not applicable (i.e., > 1000 C)
Melting point.....	Not applicable	Specific gravity (H2O = 1.0).....	3.15
Evaporation rate.....	Not applicable		

Section 10 - STABILITY AND REACTIVITY

Stability

Stable.

Conditions to avoid

Unintentional contact with water.

Incompatibility

Wet Portland cement is alkaline. As such it is incompatible with acids, ammonium salts and phosphorous.

Hazardous decomposition

Will not spontaneously occur. Adding water produces (caustic) calcium hydroxide

Hazardous Polymerization

Will not occur.

Section 11 - TOXICOLOGICAL INFORMATION

For a description of available, more detailed toxicological information contact the supplier or manufacturer.

Section 12 - ECOLOGICAL INFORMATION

Ecotoxicity

No recognized unusual toxicity to plants or animals

Relevant physical and chemical properties

(See Sections 9 and 10.)

Section 13 - DISPOSAL

Dispose of waste material according to local, state and federal regulations. (Since portland cement is stable, uncontaminated material may be saved for future use.

Dispose of bags in an approved landfill or incinerator.

Section 14 - TRANSPORTATION DATA

Hazardous materials description/proper shipping name

Portland cement is not hazardous under U.S. Department of Transportation (DOT) regulations.

Hazard class

Not applicable

Identification number

Not applicable.

Required label text

Not applicable.

Hazardous substances/reportable quantities (RQ)

Not applicable.

Section 15 - OTHER REGULATORY INFORMATION

Status under USDOL-OSHA Hazard Communication Rule, 29 CFR 1910.1200

Portland cement is considered a "hazardous chemical" under this regulation, and should be part of any hazard communication program.

Status under CERCLA/SUPERFUND 40 CFR 117 and 302

Not listed.

Hazard Category under SARA(Title III), Sections 311 and 312

Portland cement qualifies as a "hazardous substance" with delayed health effects.

Status under SARA (Title III), Section 313

Not subject to reporting requirements under Section 313.

Status under TSCA (as of May 1997)

Some substances in portland cement are on the TSCA inventory list.

Status under the Federal Hazardous Substances Act

Portland cement is a "hazardous substance" subject to statutes promulgated under the subject act.

Status under California Proposition 65

This product contains up to 0.05 percent of chemicals (trace elements) known to the State of California to cause cancer, birth defects or other reproductive harm. California law requires the manufacturer to give the above warning in the absence of definitive testing to prove that the defined risks do not exist.

Section 16 - OTHER INFORMATION

Prepared by

Kevin Keegan
Director - Health and Safety
CEMEX, Inc.
Houston, Texas

Approval date or Revision date

Approved: August, 1997
Revised: March, 2001

Other important information

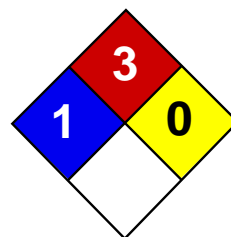
007382

Portland cement should only be used by knowledgeable persons. A key to using the product safely requires the user to recognize that portland cement chemically reacts with water, and that some of the intermediate products of this reaction (that is those present while a portland cement product is "setting") pose a more severe hazard than does dry portland cement itself.

While the information provided in this material safety data sheet is believed to provide a useful summary of the hazards of portland cement as it is commonly used, the sheet cannot anticipate and provide the all of the information that might be needed in every situation. Inexperienced product users should obtain proper training before using this product.

SELLER MAKES NO WARRANTY, EXPRESSED OR IMPLIED, CONCERNING THE PRODUCT OR THE MERCHANTABILITY OR FITNESS THEREOF FOR ANY PURPOSE OR CONCERNING THE ACCURACY OF ANY INFORMATION PROVIDED BY CEMEX, Inc. except that the product shall conform to contracted specifications. The information provided herein was believed by CEMEX, Inc. to be accurate at the time of preparation or prepared from sources believed to be reliable, but it is the responsibility of the user to investigate and understand other pertinent sources of information to comply with all laws and procedures applicable to the safe handling and use of product and to determine the suitability of the product for its intended use. Buyer's exclusive remedy shall be for damages and no claim of any kind, whether as to product delivered or for non-delivery of product, and whether based on contract, breach of warranty, negligence, or otherwise shall be greater in amount than the purchase price of the quantity of product in respect of which damages are claimed. In no event shall Seller be liable for incidental or consequential damages, whether Buyer's claim is based on contract, breach of warranty, negligence or otherwise.

In particular, the data furnished in this sheet do not address hazards that may be posed by other materials mixed with portland cement to produce portland cement products. Users should review other relevant material safety data sheets before working with this portland cement or working on portland cement products, for example, portland cement concrete.



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Acetone MSDS

Section 1: Chemical Product and Company Identification

Product Name: Acetone

Catalog Codes: SLA3502, SLA1645, SLA3151, SLA3808

CAS#: 67-64-1

RTECS: AL3150000

TSCA: TSCA 8(b) inventory: Acetone

CI#: Not applicable.

Synonym: 2-propanone; Dimethyl Ketone;
Dimethylformaldehyde; Pyroacetic Acid

Chemical Name: Acetone

Chemical Formula: C3-H6-O

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Acetone	67-64-1	100

Toxicological Data on Ingredients: Acetone: ORAL (LD50): Acute: 5800 mg/kg [Rat]. 3000 mg/kg [Mouse]. 5340 mg/kg [Rabbit]. VAPOR (LC50): Acute: 50100 mg/m 8 hours [Rat]. 44000 mg/m 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED]. The substance is toxic to central nervous system (CNS). The substance may be toxic to kidneys, the reproductive system, liver, skin. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 465°C (869°F)

Flash Points: CLOSED CUP: -20°C (-4°F). OPEN CUP: -9°C (15.8°F) (Cleveland).

Flammable Limits: LOWER: 2.6% UPPER: 12.8%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Slightly explosive in presence of open flames and sparks, of oxidizing materials, of acids.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards: Vapor may travel considerable distance to source of ignition and flash back.

Special Remarks on Explosion Hazards:

Forms explosive mixtures with hydrogen peroxide, acetic acid, nitric acid, nitric acid + sulfuric acid, chromic anhydride, chromyl chloride, nitrosyl chloride, hexachloromelamine, nitrosyl perchlorate, nitryl perchlorate, permonosulfuric acid, thiodiglycol + hydrogen peroxide, potassium ter-butoxide, sulfur dichloride, 1-methyl-1,3-butadiene, bromoform, carbon, air, chloroform, thitriazylperchlorate.

Section 6: Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:

Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage**Precautions:**

Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, acids, alkalis.

Storage:

Store in a segregated and approved area (flammables area) . Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Keep away from direct sunlight and heat and avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection**Engineering Controls:**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 500 STEL: 750 (ppm) from ACGIH (TLV) [United States] TWA: 750 STEL: 1000 (ppm) from OSHA (PEL) [United States] TWA: 500 STEL: 1000 [Australia] TWA: 1185 STEL: 2375 (mg/m3) [Australia] TWA: 750 STEL: 1500 (ppm) [United Kingdom (UK)] TWA: 1810 STEL: 3620 (mg/m3) [United Kingdom (UK)] TWA: 1800 STEL: 2400 from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Fruity. Mint-like. Fragrant. Ethereal

Taste: Pungent, Sweetish

Molecular Weight: 58.08 g/mole

Color: Colorless. Clear

pH (1% soln/water): Not available.

Boiling Point: 56.2°C (133.2°F)

Melting Point: -95.35 (-139.6°F)

Critical Temperature: 235°C (455°F)

Specific Gravity: 0.79 (Water = 1)

Vapor Pressure: 24 kPa (@ 20°C)

Vapor Density: 2 (Air = 1)

Volatility: Not available.

Odor Threshold: 62 ppm

Water/Oil Dist. Coeff.: The product is more soluble in water; $\log(\text{oil/water}) = -0.2$

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, ignition sources, exposure to moisture, air, or water, incompatible materials.

Incompatibility with various substances: Reactive with oxidizing agents, reducing agents, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 3000 mg/kg [Mouse]. Acute toxicity of the vapor (LC50): 44000 mg/m³ 4 hours [Mouse].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED]. Causes damage to the following organs: central nervous system (CNS). May cause damage to the following organs: kidneys, the reproductive system, liver, skin.

Other Toxic Effects on Humans:

Hazardous in case of skin contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May affect genetic material (mutagenicity) based on studies with yeast (*S. cerevisiae*), bacteria, and hamster fibroblast cells. May cause reproductive effects (fertility) based upon animal studies. May contain trace amounts of benzene and formaldehyde which may cause cancer and birth defects. Human: passes the placental barrier.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: May cause skin irritation. May be harmful if absorbed through the skin. Eyes: Causes eye irritation, characterized by a burning sensation, redness, tearing, inflammation, and possible corneal injury. Inhalation: Inhalation at high concentrations affects the sense organs, brain and causes respiratory tract irritation. It also may affect the Central Nervous System (behavior) characterized by dizziness, drowsiness, confusion, headache, muscle weakness, and possibly motor incoordination, speech abnormalities, narcotic effects and coma. Inhalation may also affect the gastrointestinal tract (nausea, vomiting). Ingestion: May cause irritation of the digestive (gastrointestinal) tract (nausea, vomiting). It may also

affect the Central Nervous System (behavior), characterized by depression, fatigue, excitement, stupor, coma, headache, altered sleep time, ataxia, tremors as well as the blood, liver, and urinary system (kidney, bladder, ureter) and endocrine system. May also have musculoskeletal effects. Chronic Potential Health Effects: Skin: May cause dermatitis. Eyes: Eye irritation.

Section 12: Ecological Information

Ecotoxicity:

Ecotoxicity in water (LC50): 5540 mg/l 96 hours [Trout]. 8300 mg/l 96 hours [Bluegill]. 7500 mg/l 96 hours [Fathead Minnow]. 0.1 ppm any hours [Water flea].

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Acetone UNNA: 1090 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Benzene California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Benzene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Benzene, Formaldehyde Connecticut hazardous material survey.: Acetone Illinois toxic substances disclosure to employee act: Acetone Illinois chemical safety act: Acetone New York release reporting list: Acetone Rhode Island RTK hazardous substances: Acetone Pennsylvania RTK: Acetone Florida: Acetone Minnesota: Acetone Massachusetts RTK: Acetone Massachusetts spill list: Acetone New Jersey: Acetone New Jersey spill list: Acetone Louisiana spill reporting: Acetone California List of Hazardous Substances (8 CCR 339): Acetone TSCA 8(b) inventory: Acetone TSCA 4(a) final test rules: Acetone TSCA 8(a) IUR: Acetone

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R11- Highly flammable. R36- Irritating to eyes. S9- Keep container in a well-ventilated place. S16- Keep away from sources of ignition - No smoking. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information**References:**

-Material safety data sheet issued by: la Commission de la Santé et de la Sécurité du Travail du Québec. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. LOLI, RTECS, HSDB databases. Other MSDSs

Other Special Considerations: Not available.

Created: 10/10/2005 08:13 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

MATERIAL SAFETY DATA SHEET

ALCONOX®

Prepared to U.S. OSHA, CMA, ANSI, Canadian WHMIS, Australian WorkSafe, Japanese Industrial Standard JIS Z 7250:2000, and European Union REACH Regulations



SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: **ALCONOX®**
CHEMICAL FAMILY NAME: Detergent.
PRODUCT USE: Critical-cleaning detergent for laboratory, healthcare and industrial applications
U.N. NUMBER: Not Applicable
U.N. DANGEROUS GOODS CLASS: Non-Regulated Material
SUPPLIER/MANUFACTURER'S NAME: Alconox, Inc.
ADDRESS: 30 Glenn St., Suite 309, White Plains, NY 10603. USA
EMERGENCY PHONE: **TOLL-FREE in USA/Canada** 800-255-3924
International calls 813-248-0585
BUSINESS PHONE: 914-948-4040
DATE OF PREPARATION: May 2011
DATE OF LAST REVISION: February 2008

SECTION 2 - HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: This product is a white granular powder with little or no odor. Exposure can be irritating to eyes, respiratory system and skin. It is a non-flammable solid. The Environmental effects of this product have not been investigated.

US DOT SYMBOLS

Non-Regulated

CANADA (WHMIS) SYMBOLS



EUROPEAN and (GHS) Hazard Symbols



Signal Word: **Warning!**

EU LABELING AND CLASSIFICATION:

Classification of the substance or mixture according to Regulation (EC) No1272/2008 Annex 1

EC# 205-633-8 This substance is not classified in the Annex I of Directive 67/548/EEC

EC# 268-356-1 This substance is not classified in the Annex I of Directive 67/548/EEC

EC# 231-838-7 This substance is not classified in the Annex I of Directive 67/548/EEC

EC# 231-767-1 This substance is not classified in the Annex I of Directive 67/548/EEC

EC# 207-638-8 Index# 011-005-00-2

EC# 205-788-1 This substance is not classified in the Annex I of Directive 67/548/EEC

GHS Hazard Classification(s):

Eye Irritant Category 2A

Hazard Statement(s):

H319: Causes serious eye irritation

Precautionary Statement(s):

P260: Do not breathe dust/fume/gas/mist/vapors/spray

P264: Wash hands thoroughly after handling

P271: Use only in well ventilated area.

P280: Wear protective gloves/protective clothing/eye protection/face protection/

Hazard Symbol(s):

[Xi] Irritant

MATERIAL SAFETY DATA SHEET

ALCONOX®

Risk Phrases:

R20: Harmful by inhalation
R36/37/38: Irritating to eyes, respiratory system and skin

Safety Phrases:

S8: Keep container dry
S22: Do not breathe dust
S24/25: Avoid contact with skin and eyes

HEALTH HAZARDS OR RISKS FROM EXPOSURE:

ACUTE: Exposure to this product may cause irritation of the eyes, respiratory system and skin. Ingestion may cause gastrointestinal irritation including pain, vomiting or diarrhea.

CHRONIC: This product contains an ingredient which may be corrosive.

TARGET ORGANS:

ACUTE: Eye, respiratory System, Skin

CHRONIC: None Known

SECTION 3 - COMPOSITION and INFORMATION ON INGREDIENTS

HAZARDOUS INGREDIENTS:	CAS #	EINECS #	ICSC #	WT %	HAZARD CLASSIFICATION; RISK PHRASES
Sodium Bicarbonate	144-55-8	205-633-8	1044	33 - 43%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Sodium (C10 – C16) Alkylbenzene Sulfonate	68081-81-2	268-356-1	Not Listed	10 – 20%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Sodium Tripolyphosphate	7758-29-4	231-838-7	1469	5 - 15%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Tetrasodium Pyrophosphate	7722-88-5	231-767-1	1140	5 - 15%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Sodium Carbonate	497-19-8	207-638-8	1135	1 - 10%	HAZARD CLASSIFICATION: [Xi] Irritant RISK PHRASES: R36
Sodium Alcohol Sulfate	151-21-3	205-788-1	0502	1 – 5%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Balance of other ingredients are non-hazardous or less than 1% in concentration (or 0.1% for carcinogens, reproductive toxins, or respiratory sensitizers).					

NOTE: ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-2004 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR, EU Directives and the Japanese Industrial Standard JIS Z 7250: 2000.

SECTION 4 - FIRST-AID MEASURES

Contaminated individuals of chemical exposure must be taken for medical attention if any adverse effect occurs. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to health professional with contaminated individual.

EYE CONTACT: If product enters the eyes, open eyes while under gentle running water for at least 15 minutes. Seek medical attention if irritation persists.

SKIN CONTACT: Wash skin thoroughly after handling. Seek medical attention if irritation develops and persists. Remove contaminated clothing. Launder before re-use.

INHALATION: If breathing becomes difficult, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Seek medical attention if breathing difficulty continues.

INGESTION: If product is swallowed, call physician or poison control center for most current information. If professional advice is not available, do not induce vomiting. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or who cannot swallow. Seek medical advice. Take a copy of the label and/or MSDS with the victim to the health professional.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing skin, or eye problems may be aggravated by prolonged contact.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and reduce over-exposure.

MATERIAL SAFETY DATA SHEET

ALCONOX®

SECTION 5 - FIRE-FIGHTING MEASURES

FLASH POINT:

AUTOIGNITION TEMPERATURE:

FLAMMABLE LIMITS (in air by volume, %):

FIRE EXTINGUISHING MATERIALS:

UNUSUAL FIRE AND EXPLOSION HAZARDS:

Explosion Sensitivity to Mechanical Impact:

Explosion Sensitivity to Static Discharge:

SPECIAL FIRE-FIGHTING PROCEDURES:

Not Flammable

Not Applicable

Lower (LEL): NA Upper (UEL): NA

As appropriate for surrounding fire. Carbon dioxide, foam, dry chemical, halon, or water spray.

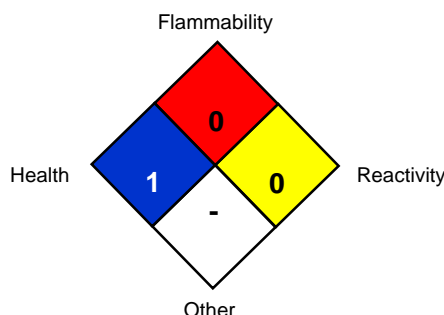
This product is non-flammable and has no known explosion hazards.

Not Sensitive.



Not Sensitive

Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Isolate materials not yet involved in the fire and protect personnel. Move containers from fire area if this can be done without risk; otherwise, cool with carefully applied water spray. If possible, prevent runoff water from entering storm drains, bodies of water, or other environmentally sensitive areas.

NFPA RATING SYSTEM



HMIS RATING SYSTEM

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM			
HEALTH HAZARD (BLUE)			1
FLAMMABILITY HAZARD (RED)			0
PHYSICAL HAZARD (YELLOW)			0
PROTECTIVE EQUIPMENT			
EYES	RESPIRATORY	HANDS	BODY
	See Sect 8		See Sect 8
For Routine Industrial Use and Handling Applications			

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard

SECTION 6 - ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Personnel should be trained for spill response operations.

SPILLS: Contain spill if safe to do so. Prevent entry into drains, sewers, and other waterways. Sweep, shovel or vacuum spilled material and place in an appropriate container for re-use or disposal. Avoid dust generation if possible. Dispose of in accordance with applicable Federal, State, and local procedures (see Section 13, Disposal Considerations).

SECTION 7 - HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling this product. Do not eat, drink, smoke, or apply cosmetics while handling this product. Avoid breathing dusts generated by this product. Use in a well-ventilated location. Remove contaminated clothing immediately.

STORAGE AND HANDLING PRACTICES: Containers of this product must be properly labeled. Store containers in a cool, dry location. Keep container tightly closed when not in use. Store away from strong acids or oxidizers.

MATERIAL SAFETY DATA SHEET

ALCONOX®

SECTION 8 - EXPOSURE CONTROLS - PERSONAL PROTECTION

EXPOSURE LIMITS/GUIDELINES:

Chemical Name	CAS#	ACGIH TWA	OSHA TWA	SWA
Sodium Bicarbonate	144-55-8	10 mg/m ³ Total Dust	15 mg/m ³ Total Dust	10 mg/m ³ Total Dust
Sodium (C10 – C16) Alkylbenzene Sulfonate	68081-81-2	10 mg/m ³ Total Dust	15 mg/m ³ Total Dust	10 mg/m ³ Total Dust
Sodium Tripolyphosphate	7758-29-4	10 mg/m ³ Total Dust	15 mg/m ³ Total Dust	10 mg/m ³ Total Dust
Tetrasodium Pyrophosphate	7722-88-5	5 mg/m ³	5 mg/m ³	5 mg/m ³
Sodium Carbonate	497-19-8	10 mg/m ³ Total Dust	15 mg/m ³ Total Dust	10 mg/m ³ Total Dust
Sodium Alcohol Sulfate	151-21-3	10 mg/m ³ Total Dust	15 mg/m ³ Total Dust	10 mg/m ³ Total Dust

Currently, International exposure limits are not established for the components of this product. Please check with competent authority in each country for the most recent limits in place.

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation to ensure exposure levels are maintained below the limits provided below. Use local exhaust ventilation to control airborne dust. Ensure eyewash/safety shower stations are available near areas where this product is used.

The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132) or equivalent standard of Canada, or standards of EU member states (including EN 149 for respiratory PPE, and EN 166 for face/eye protection), and those of Japan. Please reference applicable regulations and standards for relevant details.

RESPIRATORY PROTECTION: Based on test data, exposure limits should not be exceeded under normal use conditions when using Alconox Detergent. Maintain airborne contaminant concentrations below guidelines listed above, if applicable. If necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), equivalent U.S. State standards, Canadian CSA Standard Z94.4-93, the European Standard EN149, or EU member states.

EYE PROTECTION: Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

HAND PROTECTION: Use chemical resistant gloves to prevent skin contact.. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: Use body protection appropriate to prevent contact (e.g. lab coat, overalls). If necessary, refer to appropriate Standards of Canada, or appropriate Standards of the EU, Australian Standards, or relevant Japanese Standards.

SECTION 9 - PHYSICAL and CHEMICAL PROPERTIES

PHYSICAL STATE:	Solid
APPEARANCE & ODOR:	White granular powder with little or no odor.
ODOR THRESHOLD (PPM):	Not Available
VAPOR PRESSURE (mmHg):	Not Applicable
VAPOR DENSITY (AIR=1):	Not Applicable.
BY WEIGHT:	Not Available
EVAPORATION RATE (nBuAc = 1):	Not Applicable.
BOILING POINT (C°):	Not Applicable.
FREEZING POINT (C°):	Not Applicable.
pH:	9.5 (1% aqueous solution)
SPECIFIC GRAVITY 20°C: (WATER =1)	0.85 – 1.1
SOLUBILITY IN WATER (%)	>10% w/w
COEFFICIENT OF WATER/OIL DIST.:	Not Available
VOC:	None
CHEMICAL FAMILY:	Detergent

MATERIAL SAFETY DATA SHEET

ALCONOX®

SECTION 10 - STABILITY and REACTIVITY

STABILITY: Product is stable

DECOMPOSITION PRODUCTS: When heated to decomposition this product produces Oxides of carbon (COx)

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong acids and strong oxidizing agents.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials and dust generation.

SECTION 11 - TOXICOLOGICAL INFORMATION

TOXICITY DATA: Toxicity data is available for mixture:

CAS# 497-19-8 LD50 Oral (Rat)	4090 mg/kg
CAS# 497-19-8 LD50 Oral (Mouse)	6600 mg/kg
CAS# 497-19-8 LC50 Inhalation (Rat)	2300 mg/m ³ 2H
CAS# 497-19-8 LC50 Inhalation (Mouse)	1200 mg/m ³ 2H
CAS# 7758-29-4 LD50 Oral (Rat)	3120 mg/kg
CAS# 7758-29-4 LD50 Oral (Mouse)	3100 mg/kg
CAS# 7722-88-5 LD50 Oral (Rat)	4000 mg/kg

SUSPECTED CANCER AGENT: None of the ingredients are found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC and therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Contact with this product can be irritating to exposed skin, eyes and respiratory system.

SENSITIZATION OF PRODUCT: This product is not considered a sensitizer.

REPRODUCTIVE TOXICITY INFORMATION: No information concerning the effects of this product and its components on the human reproductive system.

SECTION 12 - ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

ENVIRONMENTAL STABILITY: No Data available at this time.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on this product's effects on plants or animals.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this product's effects on aquatic life.

SECTION 13 - DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations, those of Canada, Australia, EU Member States and Japan.

SECTION 14 - TRANSPORTATION INFORMATION

US DOT; IATA; IMO; ADR:

THIS PRODUCT IS NOT HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Non-Regulated Material

HAZARD CLASS NUMBER and DESCRIPTION: Not Applicable

UN IDENTIFICATION NUMBER: Not Applicable

PACKING GROUP: Not Applicable.

DOT LABEL(S) REQUIRED: Not Applicable

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2004): Not Applicable

MARINE POLLUTANT: None of the ingredients are classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B)

U.S. DEPARTMENT OF TRANSPORTATION (DOT) SHIPPING REGULATIONS:

This product is not classified as dangerous goods, per U.S. DOT regulations, under 49 CFR 172.101.

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:

This product is not classified as Dangerous Goods, per regulations of Transport Canada.

INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA):

This product is not classified as Dangerous Goods, by rules of IATA:

INTERNATIONAL MARITIME ORGANIZATION (IMO) DESIGNATION:

This product is not classified as Dangerous Goods by the International Maritime Organization.

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR):

MATERIAL SAFETY DATA SHEET

ALCONOX®

This product is not classified by the United Nations Economic Commission for Europe to be dangerous goods.

SECTION 15 - REGULATORY INFORMATION

UNITED STATES REGULATIONS

SARA REPORTING REQUIREMENTS: This product is not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act., as follows: None

TSCA: All components in this product are listed on the US Toxic Substances Control Act (TSCA) inventory of chemicals.

SARA 311/312:

Acute Health: Yes Chronic Health: No Fire: No Reactivity: No

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for this product. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

U.S. CERCLA REPORTABLE QUANTITY (RQ): None

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): None of the ingredients are on the California Proposition 65 lists.

CANADIAN REGULATIONS:

CANADIAN DSL/NDL INVENTORY STATUS: All of the components of this product are on the DSL Inventory

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: No component of this product is on the CEPA First Priorities Substance Lists.

CANADIAN WHMIS CLASSIFICATION and SYMBOLS: This product is categorized as a Controlled Product, Hazard Class D2B as per the Controlled Product Regulations

EUROPEAN ECONOMIC COMMUNITY INFORMATION:

EU LABELING AND CLASSIFICATION:

Classification of the mixture according to Regulation (EC) No1272/2008. See section 2 for details.

AUSTRALIAN INFORMATION FOR PRODUCT:

AUSTRALIAN INVENTORY OF CHEMICAL SUBSTANCES (AICS) STATUS: All components of this product are listed on the AICS.

STANDARD FOR THE UNIFORM SCHEDULING OF DRUGS AND POISONS: Not applicable.

JAPANESE INFORMATION FOR PRODUCT:

JAPANESE MINISTER OF INTERNATIONAL TRADE AND INDUSTRY (MITI) STATUS: The components of this product are not listed as Class I Specified Chemical Substances, Class II Specified Chemical Substances, or Designated Chemical Substances by the Japanese MITI.

INTERNATIONAL CHEMICAL INVENTORIES:

Listing of the components on individual country Chemical Inventories is as follows:

Asia-Pac:	Listed
Australian Inventory of Chemical Substances (AICS):	Listed
Korean Existing Chemicals List (ECL):	Listed
Japanese Existing National Inventory of Chemical Substances (ENCS):	Listed
Philippines Inventory of Chemicals and Chemical Substances (PICCS):	Listed
Swiss Giftliste List of Toxic Substances:	Listed
U.S. TSCA:	Listed

SECTION 16 - OTHER INFORMATION

PREPARED BY: Paul Eigbrett Global Safety Management, 10006 Cross Creek Blvd. Suite 440, Tampa, FL 33647

MATERIAL SAFETY DATA SHEET

ALCONOX®

Disclaimer: To the best of Alconox, Inc. knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness is not guaranteed and no warranties of any type either express or implied are provided. The information contained herein relates only to this specific product.

ANNEX:

IDENTIFIED USES OF ALCONOX® AND DIRECTIONS FOR USE

Used to clean: Healthcare instruments, laboratory ware, vacuum equipment, tissue culture ware, personal protective equipment, sampling apparatus, catheters, tubing, pipes, radioactive contaminated articles, optical parts, electronic components, pharmaceutical apparatus, cosmetics manufacturing equipment, metal castings, forgings and stampings, industrial parts, tanks and reactors. Authorized by USDA for use in federally inspected meat and poultry plants. Passes inhibitory residue test for water analysis. FDA certified.

Used to remove: Soil, grit, grime, buffing compound, slime, grease, oils, blood, tissue, salts, deposits, particulates, solvents, chemicals, radioisotopes, radioactive contaminations, silicon oils, mold release agents.

Surfaces cleaned: Corrosion inhibited formulation recommended for glass, metal, stainless steel, porcelain, ceramic, plastic, rubber and fiberglass. Can be used on soft metals such as copper, aluminum, zinc and magnesium if rinsed promptly. Corrosion testing may be advisable.

Cleaning method: Soak, brush, sponge, cloth, ultrasonic, flow through clean-in-place. Will foam—not for spray or machine use.

Directions: Make a fresh 1% solution (2 1/2 Tbsp. per gal., 1 1/4 oz. per gal. or 10 grams per liter) in cold, warm, or hot water. If available use warm water. Use cold water for blood stains. For difficult soils, raise water temperature and use more detergent. Clean by soak, circulate, wipe, or ultrasonic method. Not for spray machines, will foam. For nonabrasive scouring, make paste. Use 2% solution to soak frozen stopcocks. To remove silver tarnish, soak in 1% solution in aluminum container. RINSE THOROUGHLY—preferably with running water. For critical cleaning, do final or all rinsing in distilled, deionized, or purified water. For food contact surfaces, rinse with potable water. Used on a wide range of glass, ceramic, plastic, and metal surfaces. Corrosion testing may be advisable.



Material Safety Data Sheet Conductivity Standards

Section 1 - Chemical Product and Company Identification

MSDS Name:

Conductivity Standards

Catalog Numbers:

LC18750, LC18755, LC18760, LC18765, LC18771, LC18772, LC18773, LC18774, LC18775,
LC18777, LC18779, LC18780, LC18786, LC18787, LC18789, LC18791

Synonyms:

Potassium chloride solutions

Company Identification:

LabChem, Inc.
200 William Pitt Way
Pittsburgh, PA 15238

Company Phone Number:

(412) 826-5230

Emergency Phone Number:

(800) 424-9300

CHEMTREC Phone Number:

(800) 424-9300 or 011-703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name:	Percent
7447-40-7	Potassium chloride	0.26-7.4
7732-18-5	Water	balance

Section 3 - Hazards Identification

Emergency Overview

Appearance: Clear, colorless solutions

Expected to be non-hazardous.

Target Organs: None known.

Potential Health Effects

Eye:

Non-irritating to the eyes.

Skin:

Non-irritating to the skin.

Ingestion:

No hazard is expected during normal use.

Inhalation:

No hazard expected during normal use.

Chronic:

No information found.



Material Safety Data Sheet Conductivity Standards

Section 4 - First Aid Measures

Eyes:

If irritation develops, get medical aid.

Skin:

Get medical aid if irritation develops or persists.

Ingestion:

Do NOT induce vomiting. Get medical aid.

Inhalation:

No specific treatment is necessary since this material is not likely to be hazardous by inhalation.

Notes to Physician:

Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.

Extinguishing Media:

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam.

Autoignition Temperature:

No information found.

Flash Point:

No information found.

NFPA Rating:

CAS# 7447-40-7: Health- 1, Flammability- 0, Instability- 1.

CAS# 7732-18-5: Health- 0, Flammability- 0, Instability- 0.

Explosion Limits:

Lower: n/a Upper: n/a

Section 6 - Accidental Release Measures

General Information:

Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Absorb spill using an absorbent, non-combustible material such as earth, sand, diatomaceous earth, vermiculite, or other suitable absorbent.

Section 7 - Handling and Storage

Handling:

Wash thoroughly after handling. Do not ingest or inhale. Avoid contact with eyes, skin and clothing.



Material Safety Data Sheet Conductivity Standards

Storage:

Store capped at room temperature.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls:

Good general ventilation should be sufficient to control airborne levels.

Exposure Limits:

Chemical Name:	ACGIH	NIOSH	OSHA
Potassium chloride	None of the components are on this list.	None of the components are on this list.	None of the components are on this list.
Water	None of the components are on this list.	None of the components are on this list.	None of the components are on this list.

OSHA Vacated PELs:

None listed.

Personal Protective Equipment**Eyes:**

Wear safety glasses and chemical goggles if splashing is possible. Provide an eye-wash fountain in the immediate work area. Do not wear contact lenses when working with chemicals. Do not wear contact lenses when working with chemicals.

Skin:

Wear appropriate gloves to prevent skin contact.

Clothing:

Wear appropriate clothing to prevent skin contact.

Respirators:

Not required for normal use.

Section 9 - Physical and Chemical Properties

Physical State:	Liquid
Color:	Colorless
Odor:	Odorless
pH:	No information found.
Vapor Pressure:	14 mm Hg @ 20C
Vapor Density:	0.7 (water)
Evaporation Rate:	<Ether
Viscosity:	No information found.
Boiling Point:	212°F (100.00°C)
Freezing/Melting Point:	32°F (0.00°C)
Decomposition Temperature:	No information found.
Solubility in water:	Soluble.
Specific Gravity/Density:	1.0 – 1.1
Molecular Formula:	No information found.
Molecular Weight:	No information found.

Section 10 - Stability and Reactivity



Material Safety Data Sheet Conductivity Standards

Chemical Stability:

Stable under normal temperatures and pressures.

Conditions to Avoid:

Temperatures above recommended temperatures.

Incompatibilities with Other Materials:

Strong oxidizing agents, strong acids, bromine trifluoride, sulfuric acid, potassium permanganate.

Hazardous Decomposition Products:

Hydrogen chloride, chlorine, potassium fume.

Hazardous Polymerization:

Will not occur.

Section 11 - Toxicological Information

RTECS:

CAS# 7447-40-7: TS8050000.

CAS# 7732-18-5: ZC0110000.

LD50/LC50:

CAS# 7447-40-7:

Oral, mouse: LD50 = 1500 mg/kg

Oral, rat: LD50 = 2600 mg/kg.

CAS# 7732-18-5:

Oral, rat: LD50 = >90 mL/kg.

Carcinogenicity:

CAS# 7447-40-7: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

CAS# 7732-18-5: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

Epidemiology:

No information found.

Teratogenicity:

No information found.

Reproductive:

No information found.

Mutagenicity:

See actual entry in RTECS for complete information.

Neurotoxicity:

No information found.

Section 12 - Ecological Information

No information found.

Section 13 - Disposal Considerations

Dispose of in accordance with Federal, State, and local regulations.



Material Safety Data Sheet Conductivity Standards

Section 14 - Transport Information

US DOT

Shipping Name: Not regulated.

Hazard Class:

UN Number:

Packing Group:

Section 15 - Regulatory Information

US Federal

TSCA:

CAS# 7447-40-7 is listed on the TSCA Inventory.

CAS# 7732-18-5 is listed on the TSCA Inventory.

SARA Reportable Quantities (RQ):

None of the components are on this list.

CERCLA/SARA Section 313:

None of the components are on this list.

OSHA - Highly Hazardous:

None of the components are on this list.

US State

State Right to Know:

None of the chemicals in this product are present on state Right-to-Know lists from California, Pennsylvania, New Jersey, Massachusetts, or Minnesota.

California Regulations:

None.

European/International Regulations

Canadian DSL/NDL:

CAS# 7447-40-7 is listed on Canada's DSL List.

CAS# 7732-18-5 is listed on Canada's DSL List.

Canada Ingredient Disclosure List:

CAS# 7447-40-7 is not listed on Canada's Ingredient Disclosure List.

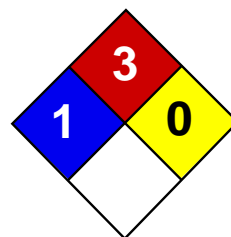
CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.

Section 16 - Other Information

MSDS Creation Date: November 6, 1997

Revision Date: August 15, 2012

Information in this MSDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc. assumes no liability resulting from the use of this MSDS. The user must determine suitability of this information for his application.



Health	2
Fire	3
Reactivity	0
Personal Protection	G

Material Safety Data Sheet

Hexanes MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hexanes

Catalog Codes: SLH2335, SLH2032

CAS#: 110-54-3

RTECS: MN9275000

TSCA: TSCA 8(b) inventory: Hexane

CI#: Not applicable.

Synonym:

Chemical Name: Hexane

Chemical Formula: C₆-H₁₄

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Hexanes	110-54-3	98.5-99.9

Toxicological Data on Ingredients: Hexane: ORAL (LD50): Acute: 25000 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of skin contact (permeator), of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant).

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to peripheral nervous system, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 225°C (437°F)

Flash Points: CLOSED CUP: -22.5°C (-8.5°F). (TAG)

Flammable Limits: LOWER: 1.15% UPPER: 7.5%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances:

Highly flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable liquid, insoluble in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards:

Extremely flammable liquid and vapor. Vapor may cause flash fire.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Flammable liquid, insoluble in water. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:

Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves (impervious).

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 500 (ppm) from OSHA (PEL) [United States] Inhalation TWA: 1800 (mg/m3) from OSHA (PEL) [United States] Inhalation TWA: 176 (mg/m3) from ACGIH (TLV) [United States] SKIN TWA: 50 (ppm) from ACGIH (TLV) [United States] SKIN TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) [United States] Inhalation TWA: 1760 STEL: 3500 (mg/m3) from ACGIH (TLV) [United States] Inhalation Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Gasoline-like or petroleum-like (Slight.)

Taste: Not available.

Molecular Weight: 86.18g/mole

Color: Clear Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 68°C (154.4°F)

Melting Point: -95°C (-139°F)

Critical Temperature: Not available.

Specific Gravity: 0.66 (Water = 1)

Vapor Pressure: 17.3 kPa (@ 20°C)

Vapor Density: 2.97 (Air = 1)

Volatility: Not available.

Odor Threshold: 130 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.9

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:

Soluble in diethyl ether, acetone. Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not available.

Special Remarks on Reactivity: Hexane can react vigorously with strong oxidizers (e.g. chlorine, bromine, fluorine)

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 25000 mg/kg [Rat]. Acute toxicity of the gas (LC50): 48000 ppm 4 hours [Rat].

Chronic Effects on Humans:

MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: peripheral nervous system, skin, central nervous system (CNS).

Other Toxic Effects on Humans:

Very hazardous in case of ingestion, of inhalation. Hazardous in case of skin contact (permeator). Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects based on animal data. May be tumorigenic based on animal data. May affect genetic material. Passes through the placental barrier in animal.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: May cause mild skin irritation. It can be absorbed through the skin in harmful amounts. Eyes: May cause mild eye irritation. Inhalation: May be harmful if inhaled. Inhalation of vapors may cause respiratory tract irritation. Overexposure may affect, brain, spinal cord, behavior/central and peripheral nervous systems (lightheadness, dizziness, hallucinations, paralysis, blurred vision, memory loss, headache, euphoria, general anesthetic, muscle weakness, numbness of the extremities, asphyxia, unconsciousness and possible death), metabolism, respiration, blood, cardiovascular system, gastrointestinal system (nausea) Ingestion: May be harmful if swallowed. May cause gastrointestinal tract irritation with abdominal pain and nausea. May also affect the liver, blood, brain, peripheral and central nervous systems. Symptoms of over exposure by ingestion are similar to that of overexposure by inhalation.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations**Waste Disposal:**

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Hexane UNNA: 1208 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information**Federal and State Regulations:**

Connecticut hazardous material survey.: Hexanes Illinois toxic substances disclosure to employee act: Hexanes Illinois chemical safety act: Hexanes New York release reporting list: Hexanes Rhode Island RTK hazardous substances: Hexanes Pennsylvania RTK: Hexanes Florida: Hexanes Minnesota: Hexanes Massachusetts RTK: Hexanes Massachusetts spill list: Hexanes New Jersey: Hexanes New Jersey spill list: Hexanes Louisiana spill reporting: Hexanes TSCA 8(b) inventory: Hexanes SARA 313 toxic chemical notification and release reporting: Hexanes CERCLA: Hazardous substances.: Hexanes: 5000 lbs. (2268 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:**WHMIS (Canada):**

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R11- Highly flammable. R20- Harmful by inhalation. R38- Irritating to skin. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. R62- Possible risk of impaired fertility. R65- Harmful: may cause lung damage if swallowed. R67- Vapors may cause drowsiness or dizziness. S9- Keep container in a well-ventilated place. S16- Keep away from sources of ignition - No smoking. S29- Do not empty into drains. S33- Take precautionary measures against static discharges. S36/37- Wear suitable protective clothing and gloves. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets. S62- If swallowed, do not induce vomiting: seek medical advice immediately and show this

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: g

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves (impervious). Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

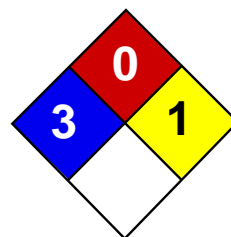
References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:19 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.



Health	3
Fire	0
Reactivity	1
Personal Protection	

Material Safety Data Sheet

Hydrochloric acid MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hydrochloric acid

Catalog Codes: SLH1462, SLH3154

CAS#: Mixture.

RTECS: MW4025000

TSCA: TSCA 8(b) inventory: Hydrochloric acid

CI#: Not applicable.

Synonym: Hydrochloric Acid; Muriatic Acid

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Hydrogen chloride	7647-01-0	20-38
Water	7732-18-5	62-80

Toxicological Data on Ingredients: Hydrogen chloride: GAS (LC50): Acute: 4701 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth. Repeated or prolonged exposure to the substance can produce target

organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of metals

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:

Non combustible. Calcium carbide reacts with hydrogen chloride gas with incandescence. Uranium phosphide reacts with hydrochloric acid to release spontaneously flammable phosphine. Rubidium acetylene carbides burns with slightly warm hydrochloric acid. Lithium silicide in contact with hydrogen chloride becomes incandescent. When dilute hydrochloric acid is used, gas spontaneously flammable in air is evolved. Magnesium boride treated with concentrated hydrochloric acid produces spontaneously flammable gas. Cesium acetylene carbide burns hydrogen chloride gas. Cesium carbide ignites in contact with hydrochloric acid unless acid is dilute. Reacts with most metals to produce flammable Hydrogen gas.

Special Remarks on Explosion Hazards:

Hydrogen chloride in contact with the following can cause an explosion, ignition on contact, or other violent/vigorous reaction: Acetic anhydride AgClO + CCl₄ Alcohols + hydrogen cyanide, Aluminum Aluminum-titanium alloys (with HCl vapor), 2-Amino ethanol, Ammonium hydroxide, Calcium carbide Ca₃P₂ Chlorine + dinitroanilines (evolves gas), Chlorosulfonic acid Cesium carbide Cesium acetylene carbide, 1,1-Difluoroethylene Ethylene diamine Ethylene imine, Fluorine, HClO₄ Hexalithium disilicide H₂SO₄ Metal acetylides or carbides, Magnesium boride, Mercuric sulfate, Oleum, Potassium permanganate, beta-Propiolactone Propylene oxide Rubidium carbide, Rubidium, acetylene carbide Sodium (with aqueous HCl), Sodium hydroxide Sodium tetraselenium, Sulfonic acid, Tetraselenium tetranitride, U₃P₄, Vinyl acetate. Silver perchlorate with carbon tetrachloride in the presence of hydrochloric acid produces trichloromethyl perchlorate which detonates at 40 deg. C.

Section 6: Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:

Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, organic materials, metals, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

CEIL: 5 (ppm) from OSHA (PEL) [United States] CEIL: 7 (mg/m³) from OSHA (PEL) [United States] CEIL: 5 from NIOSH CEIL: 7 (mg/m³) from NIOSH TWA: 1 STEL: 5 (ppm) [United Kingdom (UK)] TWA: 2 STEL: 8 (mg/m³) [United Kingdom (UK)] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Pungent. Irritating (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point:

108.58 C @ 760 mm Hg (for 20.22% HCl in water) 83 C @ 760 mm Hg (for 31% HCl in water) 50.5 C (for 37% HCl in water)

Melting Point:

-62.25°C (-80°F) (20.69% HCl in water) -46.2 C (31.24% HCl in water) -25.4 C (39.17% HCl in water)

Critical Temperature: Not available.

Specific Gravity:

1.1- 1.19 (Water = 1) 1.10 (20% and 22% HCl solutions) 1.12 (24% HCl solution) 1.15 (29.57% HCl solution) 1.16 (32% HCl solution) 1.19 (37% and 38% HCl solutions)

Vapor Pressure: 16 kPa (@ 20°C) average

Vapor Density: 1.267 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.25 to 10 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility: Soluble in cold water, hot water, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, water

Incompatibility with various substances:

Highly reactive with metals. Reactive with oxidizing agents, organic materials, alkalis, water.

Corrosivity:

Extremely corrosive in presence of aluminum, of copper, of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Reacts with water especially when water is added to the product. Absorption of gaseous hydrogen chloride on mercuric sulfate becomes violent @ 125 deg. C. Sodium reacts very violently with gaseous hydrogen chloride. Calcium phosphide and hydrochloric acid undergo very energetic reaction. It reacts with oxidizers releasing chlorine gas. Incompatible with, alkali metals, carbides, borides, metal oxides, vinyl acetate, acetylides, sulphides, phosphides, cyanides, carbonates. Reacts with most metals to produce flammable Hydrogen gas. Reacts violently (moderate reaction with heat of evolution) with water especially when water is added to the product. Isolate hydrogen chloride from heat, direct sunlight, alkalies (reacts vigorously), organic materials, and oxidizers (especially nitric acid and chlorates), amines, metals, copper and alloys (e.g. brass), hydroxides, zinc (galvanized materials), lithium silicide (incandescence), sulfuric acid(increase in temperature and pressure) Hydrogen chloride gas is emitted when this product is in contact with sulfuric acid. Adsorption of Hydrochloric Acid onto silicon dioxide results in exothermic reaction. Hydrogen chloride causes aldehydes and epoxides to violently polymerize. Hydrogen chloride or Hydrochloric Acid in contact with the following can cause explosion or ignition on contact or

Special Remarks on Corrosivity:

Highly corrosive. Incompatible with copper and copper alloys. It attacks nearly all metals (mercury, gold, platinum, tantalum, silver, and certain alloys are exceptions). It is one of the most corrosive of the nonoxidizing acids in contact with copper alloys. No corrosivity data on zinc, steel. Severe Corrosive effect on brass and bronze

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:

Acute oral toxicity (LD50): 900 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 1108 ppm, 1 hours [Mouse]. Acute toxicity of the vapor (LC50): 3124 ppm, 1 hours [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. May cause damage to the following organs: kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth.

Other Toxic Effects on Humans:

Very hazardous in case of skin contact (corrosive, irritant, permeator), of ingestion, . Hazardous in case of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals:

Lowest Published Lethal Doses (LDL/LCL) LDL [Man] -Route: Oral; 2857 ug/kg LCL [Human] - Route: Inhalation; Dose: 1300 ppm/30M LCL [Rabbit] - Route: Inhalation; Dose: 4413 ppm/30M

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects (fetotoxicity). May affect genetic material.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Corrosive. Causes severe skin irritation and burns. Eyes: Corrosive. Causes severe eye irritation/conjunctivitis, burns, corneal necrosis. Inhalation: May be fatal if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inhalation of hydrochloric acid fumes produces nose, throat, and laryngeal burning, and irritation, pain and inflammation, coughing, sneezing, choking sensation, hoarseness, laryngeal spasms, upper respiratory tract edema, chest pains, as well as headache, and palpitations. Inhalation of high concentrations can result in corrosive burns, necrosis of bronchial epithelium, constriction of the larynx and bronchi, nasospetal perforation, glottal closure, occur, particularly if exposure is prolonged. May affect the liver. Ingestion: May be fatal if swallowed. Causes irritation and burning, ulceration, or perforation of the gastrointestinal tract and resultant peritonitis, gastric hemorrhage and infection. Can also cause nausea, vomiting (with "coffee ground" emesis), diarrhea, thirst, difficulty swallowing, salivation, chills, fever, uneasiness, shock, strictures and stenosis (esophageal, gastric, pyloric). May affect behavior (excitement), the cardiovascular system (weak rapid pulse, tachycardia), respiration (shallow respiration), and urinary system (kidneys- renal failure, nephritis). Acute exposure via inhalation or ingestion can also cause erosion of tooth enamel. Chronic Potential Health Effects: dyspnea, bronchitis. Chemical pneumonitis and pulmonary edema can also

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification : Hydrochloric acid, solution UNNA: 1789 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Connecticut hazardous material survey.: Hydrochloric acid Illinois toxic substances disclosure to employee act: Hydrochloric acid Illinois chemical safety act: Hydrochloric acid New York release reporting list: Hydrochloric acid Rhode Island RTK hazardous substances: Hydrochloric acid Pennsylvania RTK: Hydrochloric acid Minnesota: Hydrochloric acid Massachusetts RTK: Hydrochloric acid Massachusetts spill list: Hydrochloric acid New Jersey: Hydrochloric acid New Jersey spill list: Hydrochloric acid Louisiana RTK reporting list: Hydrochloric acid Louisiana spill reporting: Hydrochloric acid California Director's List of Hazardous Substances: Hydrochloric acid TSCA 8(b) inventory: Hydrochloric acid TSCA 4(a) proposed test rules: Hydrochloric acid SARA 302/304/311/312 extremely hazardous substances: Hydrochloric acid SARA 313 toxic chemical notification and release reporting: Hydrochloric acid CERCLA: Hazardous substances.: Hydrochloric acid: 5000 lbs. (2268 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):

R34- Causes burns. R37- Irritating to respiratory system. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 1

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:

Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References:

-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangereuses au Canada. Centre de conformité international Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 05:45 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

IDENTITY: 70% ISOPROPYL ALCOHOL, ISOPROPANOL Product No. VT380

Product No. VT380

Tel: 412-826-5230

Emergency No. 800-424-9300

HAZARDOUS COMPONENTS	CAS NO.	OSHA PEL	ACGIH TLV	OTHER	%
Isopropyl Alcohol	CAS 67-63-0	400 PPM TWA	200 ppm TWA	500ppm STEL	70

DOT Labeling: Isopropyl Alcohol, Cls 3 (Flammable Liquid), UN 1219, PG II

PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: 180°F
Vapor Pressure (mmHg): 96 mm Hg at 100 , Deg F
Vapor Density (Air=1): 2.07
Specific Gravity (H2O=1): 0.850
Melting Point: Not Available
Evaporation Rate (Butyl Acetate=1): 2.3
Solubility in Water: Complete
Appearance/Color/Odor: Clear, colorless liquid with aromatic odor.

FIRE AND EXPLOSION HAZARD DATA

Flash Point: 54 Deg F
 Flammable limits: LEL 2.0%
 UEL 12.7%
 Extinguishing Media: Alcohol type foam, CO 2, or dry chemical.

Special fire fighting procedures: Use water to cool containers and to disperse vapors. Wear breathing apparatus and protective clothing.

Unusual fire and explosion hazards: Vapors form and may travel to open flames and sparks. Vapors may settle in low areas.

REACTIVITY DATA

Stability: Stable
Conditions to avoid: Storage at high temperatures.
Materials to avoid/Incompatibility: Oxidizing agents, nitric acid, and sulfuric acid.

Hazardous Decomposition/Byproducts: Carbon dioxide and carbon monoxide.
Hazardous Polymerization: Will not occur.

70% Isopropyl Alcohol, Isopropanol Continued.....

HEALTH HAZARD DATA

Routes of entry: Inhalation, skin, ingestion.

Health Hazards: Acute- Can cause nausea, vomiting, headache, drowsiness, drunken behavior, fatigue, weakness, confusion, abdominal pain, or coma.

Chronic-

Signs of Exposure: Nausea, vomiting, headache, drowsiness, dizziness, faintness, euphoria, decreased awareness, shortness of breath, leg cramps, visual disturbances, coma, or death.

Emergency and First Aid Procedures:

Eye Contact: Rinse with water for at least 15 minutes, seek medical attention.

Skin Contact: Wash with soap and water for 15 minutes.

Ingestion: If conscious, induce vomiting, seek medical help immediately.

Inhalation: Remove to fresh air assist breathing as necessary.

Medical Conditions Aggravated by Exposure: Respiratory, coronary, and liver conditions.

Carcinogenicity: None known.

PRECAUTIONS FOR SAFE HANDLING AND USE

Precautions to be taken in handling and storage: Store in a flammable safety cabinet or room. Use in a well-ventilated area, keep away from open flames sparks or sources of ignition.

Spill or Release Procedures: Absorb material with a non-flammable material such as sand, and place it in a sealed container. Notify personnel to clear area. Turn off any sources of flame or sparks.

Spill or Release: "Reportable Quantity" (RQ) to National Response Center 1-800-424-8802, 40 CFR Part 302: None

Waste Disposal Methods: In accordance with local, state, and federal regulations.

CONTROL MEASURES/PERSONAL PROTECTION

Respiratory Protection: If exposure limit is exceeded, a NIOSH approved respirator should be used.

Eye Protection: Goggles or full face shield.

Protective Gloves: Neoprene or PVC.

Protective Clothing: Outer garments not affected by the product.

Ventilation Requirements: Non sparking system.

Work and Hygienic Practices: Handle as a highly flammable liquid and wear appropriate personal safety equipment.

OTHER

NFPA Hazard Rating: Health- 1

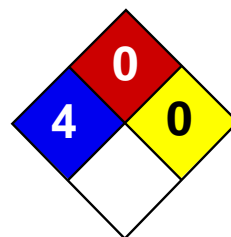
Flammability- 3

Reactivity- 0

KEY: 0-None, 1-Slight, 2-Moderate, 3-Severe, 4-Extreme

SARA TITLE III- In compliance with Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 and 40 CFR Part 372 the following toxic chemicals are present: None.

THE ABOVE INFORMATION IS BELIEVED TO BE TRUE AND CORRECT AT THIS TIME. HOWEVER NO GUARANTEE IS EXPRESSED OR IMPLIED.



Health	3
Fire	0
Reactivity	0
Personal Protection	

Material Safety Data Sheet

Nitric acid, 65% MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nitric acid, 65%

Catalog Codes: SLN2161

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Water; Nitric acid, fuming

CI#: Not applicable.

Synonym: Nitric Acid, 65%

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Water	7732-18-5	35
Nitric acid, fuming	7697-37-2	65

Toxicological Data on Ingredients: Nitric acid, fuming: VAPOR (LC50): Acute: 244 ppm 0.5 hours [Rat]. 344 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to lungs, mucous membranes, upper respiratory

tract, skin, eyes, teeth. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of combustible materials

Explosion Hazards in Presence of Various Substances:

Explosive in presence of reducing materials, of organic materials, of metals, of alkalis. Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:

Flammable in presence of cellulose or other combustible materials. Phosphine, hydrogen sulfide, selenide all ignite when fuming nitric acid is dripped into gas. (Nitric Acid, fuming)

Special Remarks on Explosion Hazards:

Reacts explosively with metallic powders, carbides, cyanides, sulfides, alkalies and turpentine. Can react explosively with many reducing agents. Arsine, phosphine, tetraborane all oxidized explosively in presence of nitric acid. Cesium and rubidium

acetylides explode in contact with nitric acid. Explosive reaction with Nitric Acid + Nitrobenzene + water. Detonation with Nitric Acid + 4-Methylcyclohexane. (Nitric acid, fuming)

Section 6: Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:

Corrosive liquid. Oxidizing material. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Keep away from combustible material.. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as reducing agents, combustible materials, organic materials, metals, acids, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage:

Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles. See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizers. Do not store above 23°C (73.4°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 2 STEL: 4 (ppm) from ACGIH (TLV) [United States] TWA: 2 STEL: 4 from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Acrid. Disagreeable and choking. (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point: 121°C (249.8°F)

Melting Point: -41.6°C (-42.9°F)

Critical Temperature: Not available.

Specific Gravity: 1.408 (Water = 1)

Vapor Pressure: 6 kPa (@ 20°C)

Vapor Density: 2.5 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.29 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility:
Easily soluble in cold water, hot water. Soluble in diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances:
Highly reactive with alkalis. Reactive with reducing agents, combustible materials, organic materials, metals, acids.

Corrosivity:
Extremely corrosive in presence of aluminum, of copper. Non-corrosive in presence of glass, of stainless steel(304), of stainless steel(316), of brass.

Special Remarks on Reactivity:
A strong oxidizer. Reacts violently with alcohol, organic material, turpene, charcoal. Violent reaction with Nitric acid + Acetone and Sulfuric acid. Nitric Acid will react with water or steam to produce heat and toxic, corrosive and flammable vapors. (Nitric acid, fuming)

Special Remarks on Corrosivity:
In presence of traces of oxides, it attacks all base metals except aluminum and special chromium steels. It will attack some forms of plastics, rubber, and coatings. No corrosive effect on bronze. No corrosivity data for zinc, and steel

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans:

Contains material which may cause damage to the following organs: lungs, mucous membranes, upper respiratory tract, skin, eyes, teeth.

Other Toxic Effects on Humans:

Extremely hazardous in case of inhalation (lung corrosive). Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (corrosive), of ingestion, .

Special Remarks on Toxicity to Animals: LDL - Lowest Published Lethal Dose [Human] - Route: Oral; Dose: 430 mg/kg (Nitric acid, fuming)

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects (effects on newborn and fetotoxicity) based on animal data. (Nitric acid, fuming)

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Severely irritates skin. Causes skin burns and may cause deep and penetrating ulcers of the skin with a characteristic yellow to brownish discoloration. May be fatal if absorbed through skin. Eyes: Severely irritates eyes. Causes eye burns. May cause irreversible eye injury. Ingestion: May be fatal if swallowed. Causes serious gastrointestinal tract irritation or burns with nausea, vomiting, severe abdominal pain, and possible "coffee grounds" appearance of the vomitus . May cause perforation of the digestive tract. Inhalation: May be fatal if inhaled. Vapor is extremely hazardous. Vapor may cause nitrous gas poisoning. Effects may be delayed. May cause irritation of the mucous membranes and respiratory tract with burning pain in the nose and throat, coughing, sneezing, wheezing, shortness of breath and pulmonary edema. Other symptoms may include nausea, and vomiting. Chronic Potential Health Effects: Repeated inhalation may produce changes in pulmonary function and/or chronic bronchitis. It may also affect behavior (headache, dizziness, drowsiness, muscle contraction or spasticity, weakness, loss of coordination, mental confusion), and urinary system (kidney failure, decreased urinary output after several hours of

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Nitric acid UNNA: 2031 PG: II

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:

New York release reporting list: Nitric acid, fuming Rhode Island RTK hazardous substances: Nitric acid, fuming Pennsylvania RTK: Nitric acid, fuming Florida: Nitric acid, fuming Minnesota: Nitric acid, fuming Massachusetts RTK: Nitric acid, fuming

New Jersey: Nitric acid, fuming TSCA 8(b) inventory: Water; Nitric acid, fuming SARA 302/304/311/312 extremely hazardous substances: Nitric acid, fuming SARA 313 toxic chemical notification and release reporting: Nitric acid, fuming 65% CERCLA: Hazardous substances.: Nitric acid, fuming: 1000 lbs. (453.6 kg);

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):

CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):

R8- Contact with combustible material may cause fire. R35- Causes severe burns. S23- Do not breathe gas/fumes/vapour/spray [***] S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S36- Wear suitable protective clothing. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 0

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 4

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 10:59 AM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.



Material Safety Data Sheet

Buffer Solution pH 10.0

Section 1 - Chemical Product and Company Identification

MSDS Name:

Buffer Solution pH 10.0

Catalog Numbers:

LC12500, LC12510

Synonyms:

None

Company Identification:

LabChem Inc
200 William Pitt Way
Pittsburgh, PA 15238

Company Phone Number:

(412) 826-5230

Emergency Phone Number:

(800) 424-9300

CHEMTREC Phone Number:

(800) 424-9300

Section 2 – Composition, Information on Ingredients

CAS#	Chemical Name:	Percent
7732-18-5	Water	balance
1310-73-2	Sodium hydroxide	<1
1303-96-4	Sodium tetraborate, decahydrate	0.5
None	Non-toxic blue dye (LC12510 only)	<0.1

Section 3 - Hazards Identification

Emergency Overview**Appearance:** LC12500: clear, colorless solution; LC12510: clear, blue solution**Caution!** May cause eye and skin irritation.**Target Organs:** None.**Potential Health Effects****Eye:**

May cause eye irritation.

Skin:

May cause skin irritation.

Ingestion:

May cause gastrointestinal irritation with nausea and vomiting.

Inhalation:

May cause respiratory tract irritation.



Material Safety Data Sheet

Buffer Solution pH 10.0

Chronic:

Repeated ingestion may cause anorexia, irritation to gastrointestinal tract, nausea, vomiting, diarrhea, or skin rashes.

Section 4 - First Aid Measures

Eyes:

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid at once. Do NOT allow victim to rub or keep eyes closed.

Skin:

Get medical aid at once. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion:

Call a poison control center. If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical aid at once.

Inhalation:

Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:

Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.

Extinguishing Media:

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam.

Autoignition Temperature:

Not applicable.

Flash Point:

Not applicable.

NFPA Rating:

Health- 1, Flammability- 0, Instability- 0.

Explosion Limits:

Lower: n/a Upper: n/a

Section 6 - Accidental Release Measures

General Information:

Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Absorb spills with absorbent (vermiculite, sand, fuller's earth) and place in suitable containers labeled for later disposal.



Material Safety Data Sheet

Buffer Solution pH 10.0

Section 7 - Handling and Storage

Handling:

Wash thoroughly after handling. Avoid breathing dust, vapor, mist, or gas.

Storage:

Store capped at room temperature. Protect from heat and incompatibles.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls:

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations below the Permissible Exposure Limits.

Exposure Limits:

Chemical Name:	ACGIH	NIOSH	OSHA
Water	none listed	none listed	none listed
Sodium hydroxide	2 mg/m ³ Ceiling	10 mg/m ³ IDLH	2 mg/m ³ TWA
Sodium tetraborate	2 mg/m ³ TWA (inhalable fraction, listed under Borate compounds, inorganic); 6 mg/m ³ STEL (inhalable fraction, listed under Borate compounds, inorganic)	5 mg/m ³ TWA	none listed

OSHA Vacated PELs:

Sodium tetraborate decahydrate: 10 mg/m³ TWA

Personal Protective Equipment

Eyes:

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:

Wear appropriate gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Color: LC12500: colorless, LC12510: blue
Odor: Odorless



Material Safety Data Sheet

Buffer Solution pH 10.0

pH:	10.0
Vapor Pressure:	Not available
Vapor Density:	Not available
Evaporation Rate:	Not available
Viscosity:	Not available
Boiling Point:	Not available
Freezing/Melting Point:	Not available
Decomposition Temperature:	Not available
Solubility in water:	Soluble
Specific Gravity/Density:	1.0
Molecular Formula:	Not applicable
Molecular Weight:	Not applicable

Section 10 - Stability and Reactivity

Chemical Stability:

Stable under normal temperatures and pressures.

Conditions to Avoid:

Incompatible materials.

Incompatibilities with Other Materials:

Strong oxidizers, acids.

Hazardous Decomposition Products:

Oxides of sodium and boron.

Hazardous Polymerization:

Has not been reported.

Section 11 - Toxicological Information

RTECS:

CAS# 7732-18-5: ZC0110000.

CAS# 1310-73-2: WB4900000.

CAS# 1303-96-4: VZ2275000.

LD50/LC50:

CAS# 7732-18-5:

Oral, rat: LD50 = >90 mL/kg.

CAS# 1310-73-2:

No information found.

CAS# 1303-96-4:

Oral, mouse: LD50 = 2 gm/kg

Oral, rat: LD50 = 2660 mg/kg.

Carcinogenicity:

CAS# 7732-18-5: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

CAS# 1310-73-2: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

CAS# 1303-96-4: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.



Material Safety Data Sheet Buffer Solution pH 10.0

Epidemiology:

No information found

Teratogenicity:

No information found

Reproductive:

No information found

Mutagenicity:

No information found

Neurotoxicity:

No information found

Section 12 - Ecological Information

No information found

Section 13 - Disposal Considerations

Dispose of in accordance with Federal, State, and local regulations.

Section 14 - Transport Information

US DOT

Shipping Name: Not regulated

Hazard Class:

UN Number:

Packing Group:

Section 15 - Regulatory Information

US Federal**TSCA:**

CAS# 7732-18-5 is listed on the TSCA Inventory.

CAS# 1310-73-2 is listed on the TSCA Inventory.

CAS# 1303-96-4 is listed on the TSCA Inventory.

SARA Reportable Quantities (RQ):

CAS# 1310-73-2: final RQ = 1000 pounds (454 kg)

CERCLA/SARA Section 313:

None of the components are reportable under Section 313.

OSHA - Highly Hazardous:

None of the chemicals in this product are considered highly hazardous by OSHA.

US State**State Right to Know:**

Sodium hydroxide can be found on the following state Right-to-Know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.



Material Safety Data Sheet

Buffer Solution pH 10.0

Sodium tetraborate, decahydrate can be found on the following state Right-to-Know lists:
California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

California Regulations:

None.

European/International Regulations

Canadian DSL/NDSL:

CAS# 7732-18-5 is listed on Canada's DSL List.

CAS# 1310-73-2 is listed on Canada's DSL List.

CAS# 1303-96-4 is listed on Canada's DSL List.

Canada Ingredient Disclosure List:

CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.

CAS# 1310-73-2 is listed on Canada's Ingredient Disclosure List.

CAS# 1303-96-4 is listed on Canada's Ingredient Disclosure List.

Section 16 - Other Information

MSDS Creation Date: July 4, 1998

Revision Date: September 9, 2009

Information in this MSDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc. assumes no liability resulting from the use of this MSDS. The user must determine suitability of this information for his application.



Material Safety Data Sheet

Buffer Solutions pH 3.00, 4.00, and 5.00

Section 1 - Chemical Product and Company Identification

MSDS Name:

Buffer Solutions pH 3.00, 4.00, and 5.00

Catalog Numbers:

LC12250, LC12270, LC12280, LC12300

Synonyms:

Acid phthalate buffers, potassium biphthalate buffers, potassium dihydrogen phthalate buffers, neutralized phthalate buffers

Company Identification:

LabChem Inc
200 William Pitt Way
Pittsburgh, PA 15238

Company Phone Number:

(412) 826-5230

Emergency Phone Number:

(800) 424-9300

CHEMTREC Phone Number:

(800) 424-9300 or
011-703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name:	Percent
7732-18-5	Water	balance
877-24-7	Potassium hydrogen phthalate	>1
50-00-0	Formaldehyde	0.04
7647-01-0	Hydrochloric acid	0-0.1
1310-73-2	Sodium hydroxide	0-0.1

Section 3 - Hazards Identification

Emergency Overview

Appearance: Clear, colorless solution (LC12280- clear, red solution)

Caution! May cause irritation to eyes, skin, respiratory and gastrointestinal tracts. May cause cancer. May cause adverse liver and kidney effects.

Target Organs: Liver, kidneys, eyes, skin, respiratory and gastrointestinal tract

Potential Health Effects

Eye:

May cause eye irritation.

Skin:

May cause skin irritation.



Material Safety Data Sheet

Buffer Solutions pH 3.00, 4.00, and 5.00

Ingestion:

Causes gastrointestinal irritation with nausea, vomiting and diarrhea.

Inhalation:

May cause respiratory tract irritation.

Chronic:

May cause dermatitis and conjunctivitis. May cause adverse liver and kidney effects. May cause cancer.

Section 4 - First Aid Measures

Eyes:

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids until no evidence of chemical remains. Get medical aid at once.

Skin:

Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid.

Ingestion:

Give conscious victim 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid at once.

Inhalation:

Move victim to fresh air immediately. If breathing is difficult, administer oxygen. Give artificial respiration if necessary. Get medical aid at once.

Notes to Physician:

Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media:

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam.

Autoignition Temperature:

Not available

Flash Point:

Not applicable

NFPA Rating:

Health- 1, Flammability- 0, Instability- 0

Explosion Limits:

Lower: n/a Upper: n/a

Section 6 - Accidental Release Measures

General Information:

Use proper personal protective equipment as indicated in Section 8.



Material Safety Data Sheet

Buffer Solutions pH 3.00, 4.00, and 5.00

Spills/Leaks:

Absorb spill with inert material such as sand, vermiculite, or diatomaceous earth, and transfer to a suitable container labeled for later disposal.

Section 7 - Handling and Storage

Handling:

Wash thoroughly after handling. Do not ingest or inhale. Do not get in eyes, on skin, or on clothing.

Storage:

Store tightly capped in a cool, dry, well-ventilated area away from incompatible materials.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls:

Facilities using or storing this material should be equipped with an eyewash and safety shower. Provide local exhaust or general dilution ventilation to keep airborne levels below the permissible exposure limits.

Exposure Limits:

Chemical Name:	ACGIH	NIOSH	OSHA
Water	None listed	None listed	None listed
Potassium hydrogen phthalate	None listed	None listed	None listed
Formaldehyde	0.3 ppm Ceiling	0.016 ppm TWA 0.1 ppm Ceiling 20 ppm IDLH	0.75 ppm TWA 2 ppm STEL
Hydrochloric acid	2 ppm Ceiling	5 ppm Ceiling 50 ppm IDLH	5 ppm Ceiling
Sodium hydroxide	2 mg/m ³ Ceiling	10 mg/m ³ IDLH	2 mg/m ³ TWA

OSHA Vacated PELs:

Formaldehyde: 3 ppm TWA, 5 ppm Ceiling, 10 ppm STEL
Hydrochloric acid: 5 ppm Ceiling

Personal Protective Equipment

Eyes:

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133. Do not wear contact lenses when working with chemicals.

Skin:

Wear appropriate protective gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

Follow the OSHA respirator regulations found in 29 CFR 1910.134. Always use a NIOSH-approved respirator when necessary.



Material Safety Data Sheet

Buffer Solutions pH 3.00, 4.00, and 5.00

Section 9 - Physical and Chemical Properties

Physical State:	Liquid
Color:	Colorless
Odor:	Odorless
pH:	3-5
Vapor Pressure:	Not available
Vapor Density:	Not available
Evaporation Rate:	Not available
Viscosity:	Not available
Boiling Point:	Not available
Freezing/Melting Point:	Not available
Decomposition Temperature:	Not available
Solubility in water:	Soluble
Specific Gravity/Density:	1.0
Molecular Formula:	Not available
Molecular Weight:	Not available

Section 10 - Stability and Reactivity

Chemical Stability:

Stable under normal temperatures and pressures.

Conditions to Avoid:

Incompatible materials, excess heat.

Incompatibilities with Other Materials:

Strong oxidizing agents, nitric acid, metals, aldehydes, reducing agents, nitro compounds, halogenated hydrocarbons.

Hazardous Decomposition Products:

Carbon monoxide, carbon dioxide, potassium and sodium oxides, potassium fume, hydrogen chloride gas

Hazardous Polymerization:

Has not been reported.

Section 11 - Toxicological Information

RTECS:

CAS# 7732-18-5: ZC0110000

CAS# 877-24-7: CZ4326000

CAS# 50-00-0: LP8925000

CAS# 7647-01-0: MW4025000.

CAS# 1310-73-2: WB4900000.

LD50/LC50:

CAS# 7732-18-5:

Oral, rat: LD50 = >90 mL/kg

CAS# 877-24-7:

Oral, rat: LD50 = >3200 mg/kg

Skin, guinea pig: LD50 = >1 g/kg



Material Safety Data Sheet

Buffer Solutions pH 3.00, 4.00, and 5.00

CAS# 50-00-0:

Inhalation, rat: LC50 = 0.578 mg/L/4H

Oral, rat: LD50 = 500 mg/kg

CAS# 7647-01-0:

Inhalation, rat: LC50 = 3124 ppm/1H

Oral, rat: LD50 = 700 mg/kg

Skin, rabbit: LD50 = 5010 mg/kg

CAS# 1310-73-2:

Draize test, rabbit, eye: 1% Severe

Draize test, rabbit, skin: 500 mg/24H Severe

Carcinogenicity:

CAS# 7732-18-5: Not listed as a carcinogen by ACGIH, IARC, NTP, OSHA, or California Proposition 65.

CAS# 877-24-7: Not listed as a carcinogen by ACGIH, IARC, NTP, OSHA, or California Proposition 65.

CAS# 50-00-0: Listed as a carcinogen by ACGIH, IARC, NTP, OSHA, and California Proposition 65.

CAS# 7647-01-0: Not listed as a carcinogen by ACGIH, IARC, NTP, OSHA, or California Proposition 65.

CAS# 1310-73-2: Not listed as a carcinogen by ACGIH, IARC, NTP, OSHA, or California Proposition 65.

Epidemiology:

See actual entry in RTECS for complete information.

Teratogenicity:

Teratogenic effects have occurred in laboratory animals.

Reproductive:

Experiments have shown reproductive toxicity effects on laboratory animals.

Mutagenicity:

Mutagenic effects have occurred in microorganisms.

Neurotoxicity:

No information found.

Section 12 - Ecological Information

No information found.

Section 13 - Disposal Considerations

Dispose of in accordance with Federal, State, and local regulations.

Section 14 - Transport Information

US DOT

Shipping Name: Not regulated

Hazard Class:

UN Number:

Packing Group:



Material Safety Data Sheet

Buffer Solutions pH 3.00, 4.00, and 5.00

Section 15 - Regulatory Information

US Federal

TSCA:

CAS# 7732-18-5 is listed on the TSCA Inventory.
CAS# 877-24-7 is listed on the TSCA Inventory.
CAS# 50-00-0 is listed on the TSCA Inventory.
CAS# 7647-01-0 is listed on the TSCA Inventory.
CAS# 1310-73-2 is listed on the TSCA Inventory.

SARA Reportable Quantities (RQ):

CAS# 50-00-0: final RQ = 100 pounds (45.4 kg)
CAS# 7647-01-0: final RQ = 5000 pounds (2270 kg)
CAS# 1310-73-2: final RQ = 1000 pounds (454 kg)

CERCLA/SARA Section 313:

This material contains Hydrochloric acid (CAS# 7647-01-0, 0-0.1%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

OSHA - Highly Hazardous:

CAS# 50-00-0 is considered highly hazardous by OSHA.
CAS# 7647-01-0 is considered highly hazardous by OSHA.

US State

State Right to Know:

Formaldehyde can be found on the following state Right-to-Know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.
Hydrochloric acid can be found on the following state Right-to-Know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.
Sodium hydroxide can be found on the following state Right-to-Know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

California Regulations:

WARNING: Catalog numbers LC12250, LC12270, LC12280, and LC12300 contain formaldehyde, a chemical known to the state of California to cause cancer or birth defects or other reproductive harm.

European/International Regulations

Canadian DSL/NDSL:

CAS# 7732-18-5 is listed on Canada's DSL List.
CAS# 877-24-7 is listed on Canada's DSL List.
CAS# 50-00-0 is listed on Canada's DSL List.
CAS# 7647-01-0 is listed on Canada's DSL List.
CAS# 1310-73-2 is listed on Canada's DSL List.

Canada Ingredient Disclosure List:

CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.
CAS# 877-24-7 is not listed on Canada's Ingredient Disclosure List.
CAS# 50-00-0 is listed on Canada's Ingredient Disclosure List.
CAS# 7647-01-0 is listed on Canada's Ingredient Disclosure List.
CAS# 1310-73-2 is listed on Canada's Ingredient Disclosure List.



Material Safety Data Sheet
Buffer Solutions pH 3.00, 4.00, and 5.00

Section 16 - Other Information

MSDS Creation Date: February 14, 1998

Revision Date: October 11, 2010

Information in this MSDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc. assumes no liability resulting from the use of this MSDS. The user must determine suitability of this information for his application.



Material Safety Data Sheet

Sodium Hydroxide Solutions, 2.7-50% w/w

Section 1 - Chemical Product and Company Identification

MSDS Name:

Sodium Hydroxide Solutions, 2.7-50% w/w

Catalog Numbers:

LC24040, LC24060, LC24070, LC24075, LC24078, LC24085, LC24090, LC24095, LC24100, LC24110, LC24115, LC24120, LC24140, LC24150, LC24350, LC24380, LC24400, LC24420, LC24430, LC24450, LC24455, LC24460, LC24500, LC24523, LC24525

Synonyms:

Caustic Soda, Soda Lye, Sodium Hydrate

Company Identification:

LabChem, Inc.
200 William Pitt Way
Pittsburgh, PA 15238

Company Phone Number:

(412) 826-5230

Emergency Phone Number:

(800) 424-9300

CHEMTREC Phone Number:

(800) 424-9300 or
011-703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name:	Percent
7732-18-5	Water	>49
1310-73-2	Sodium hydroxide	2.7-50

Section 3 - Hazards Identification

Emergency Overview

Appearance: Clear, colorless solution

Danger! Corrosive. Causes burns by all exposure routes.

Target Organs: Eyes, skin, respiratory tract

Potential Health Effects

Eye:

Causes eye burns. May cause chemical conjunctivitis and corneal damage.

Skin:

Causes skin burns. May cause deep, penetrating ulcers of the skin. May cause skin rash (in milder cases) and cold, clammy skin with cyanosis or pale color.

Ingestion:

Causes gastrointestinal tract burns. Causes severe pain, nausea, vomiting, diarrhea, and shock. May cause perforation of the gastrointestinal tract.



Material Safety Data Sheet

Sodium Hydroxide Solutions, 2.7-50% w/w

Inhalation:

Causes severe irritation of upper respiratory tract with coughing, burns, breathing difficulty, chemical pneumonitis and pulmonary edema.

Chronic:

Prolonged or repeated skin contact may cause dermatitis and conjunctivitis.

Section 4 - First Aid Measures

Eyes:

Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids until no evidence of chemical remains. Get medical aid at once.

Skin:

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid at once.

Ingestion:

Do not induce vomiting. Give conscious victim 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid at once.

Inhalation:

Move victim to fresh air immediately. If breathing is difficult, administer oxygen. Give artificial respiration if necessary, using a mechanical device such as a bag and mask or one-way valve. Get medical aid at once.

Notes to Physician:

Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Use water with caution and in flooding amounts. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Contact with metals may evolve flammable hydrogen gas. Containers may explode when heated.

Extinguishing Media:

Do NOT get water inside containers. For small fires, use dry chemical, carbon dioxide, or water spray. For large fires, use dry chemical, carbon dioxide, alcohol-resistant foam, or water spray. Cool containers with flooding quantities of water until well after fire is out.

Autoignition Temperature:

Not applicable.

Flash Point:

Not applicable.

NFPA Rating:

Health- 3, Flammability- 0, Instability- 1

Explosion Limits:

Lower: No information Upper: No information



Material Safety Data Sheet

Sodium Hydroxide Solutions, 2.7-50% w/w

Section 6 - Accidental Release Measures

General Information:

Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Absorb spill with inert material such as sand, vermiculite, or diatomaceous earth, and transfer to a suitable container labeled for later disposal. Label reclaimed spill material as corrosive. Material may be carefully neutralized to pH 7 with citric acid.

Section 7 - Handling and Storage

Handling:

Wash thoroughly after handling. Do not ingest or inhale. Do not get in eyes, on skin, or on clothing. Use with adequate ventilation. Do not breathe spray or mist.

Storage:

Store in a cool, dry, well-ventilated area away from incompatible substances. Keep away from strong acids and metals.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls:

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits:

Chemical Name:	ACGIH	NIOSH	OSHA
Water	None of the components are on this list.	None of the components are on this list.	None of the components are on this list.
Sodium hydroxide	2 mg/m ³ Ceiling	10 mg/m ³ IDLH	2 mg/m ³ TWA

OSHA Vacated PELs:

None listed

Personal Protective Equipment**Eyes:**

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133. Do not wear contact lenses when working with chemicals.

Skin:

Wear appropriate protective gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

Follow the OSHA respirator regulations found in 29 CFR 1910.134. Always use a NIOSH-approved respirator when necessary.

Section 9 - Physical and Chemical Properties



Material Safety Data Sheet

Sodium Hydroxide Solutions, 2.7-50% w/w

Physical State: Liquid
Color: Clear
Odor: Not available.
pH: Alkaline
Vapor Pressure: Not available.
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: Not available.
Freezing/Melting Point: Not available.
Decomposition Temperature: Not available.
Solubility in water: Soluble
Specific Gravity/Density: 1.1-1.5
Molecular Formula: NaOH
Molecular Weight: 40.00

Section 10 - Stability and Reactivity

Chemical Stability:

Stable under normal temperatures and pressures.

Conditions to Avoid:

Incompatible materials, extreme temperatures.

Incompatibilities with Other Materials:

Metals, acids, aluminum, nitro compounds, zinc, tin, halogenated hydrocarbons, nitromethane, flammable liquids.

Hazardous Decomposition Products:

Toxic fumes of sodium oxide.

Hazardous Polymerization:

Has not been reported.

Section 11 - Toxicological Information

RTECS:

CAS# 7732-18-5: ZC0110000.

CAS# 1310-73-2: WB4900000.

LD50/LC50:

CAS# 7732-18-5:

Oral, rat: LD50 = >90 mL/kg.

CAS# 1310-73-2:

Draize test, rabbit, eye: 400 ug Mild;

Draize test, rabbit, eye: 1% Severe;

Draize test, rabbit, eye: 50 ug/24H Severe;

Carcinogenicity:

CAS# 7732-18-5: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

CAS# 1310-73-2: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

Epidemiology:

No information found.



Material Safety Data Sheet

Sodium Hydroxide Solutions, 2.7-50% w/w

Teratogenicity:

No information found.

Reproductive:

No information found.

Mutagenicity:

No information found.

Neurotoxicity:

No information found.

Section 12 - Ecological Information

No information found.

Section 13 - Disposal Considerations

Dispose of in accordance with Federal, State, and local regulations.

Section 14 - Transport Information

US DOT

Shipping Name: Sodium hydroxide solution

Hazard Class: 8

UN Number: UN1824

Packing Group: PG II

Section 15 - Regulatory Information

US Federal**TSCA:**

CAS# 7732-18-5 is listed on the TSCA Inventory.

CAS# 1310-73-2 is listed on the TSCA Inventory.

SARA Reportable Quantities (RQ):

CAS# 1310-73-2: final RQ = 1000 pounds (454 kg)

CERCLA/SARA Section 313:

None of the components are on this list.

OSHA - Highly Hazardous:

None of the components are on this list.

US State**State Right to Know:**

Sodium hydroxide can be found on the following state Right-to-Know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Regulations:

None.



Material Safety Data Sheet

Sodium Hydroxide Solutions, 2.7-50% w/w

European/International Regulations

Canadian DSL/NDSL:

CAS# 7732-18-5 is listed on Canada's DSL List.

CAS# 1310-73-2 is listed on Canada's DSL List.

Canada Ingredient Disclosure List:

CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.

CAS# 1310-73-2 is listed on Canada's Ingredient Disclosure List.

Section 16 - Other Information

MSDS Creation Date: July 6, 1998

Revision Date: January 20, 2012

Information in this MSDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc. assumes no liability resulting from the use of this MSDS. The user must determine suitability of this information for his application.

Material Safety Data Sheet

Sulfuric acid 90-98%

ACC# 22350

Section 1 - Chemical Product and Company Identification

MSDS Name: Sulfuric acid 90-98%

Catalog Numbers: AC124640000, AC124640010, AC124640011, AC124640025, AC124640026, AC124645000, AC124645001, AC133610000, AC133610011, AC133610025, AC133610026, AC133610051, AC302070000, AC302070010, AC302070011, AC302070025, AC302070026, AC388270000, AC424520000, AC424520026, AC424525001, 13361-0010, 42452-0025, 42452-5000, A298-212, A298N119, A300-212, A300-225LB, A300-500, A300-500LC, A300-612GAL, A300-700LB, A300C-212, A300C-212002, A300C-212003, A300C-212LC, A300C212004, A300C212005, A300C212006, A300C212007, A300C212008, A300C212009, A300C212010, A300J-500, A300P-500, A300S-212, A300S-212LC, A300S-500, A300SI-212, A468-1, A468-2, A468-250, A468-500, A484-212, A510-212, A510-500, A510SK-212, NC9008405, NC9825433, S71211SC, S71211SCMF, S79200, SA174-212, SA174-4, SA176-4, SA196-500

Synonyms: Hydrogen sulfate; Oil of vitriol; Vitriol brown oil; Mattling acid; Battery acid; Sulphuric acid; Electrolyte acid; Dihydrogen sulfate; Spirit of sulfur; Chamber acid.

Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100

Emergency Number: 201-796-7100

For CHEMTREC assistance, call: 800-424-9300

For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7664-93-9	Sulfuric acid	90-98	231-639-5

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: clear colorless to yellow liquid.

Danger! Causes eye and skin burns. Causes digestive and respiratory tract burns. May be fatal if mist inhaled. Strong inorganic acid mists containing sulfuric acid may cause cancer. Concentrated sulfuric acid reacts violently with water and many other substances under certain conditions. May cause lung damage. Hygroscopic (absorbs moisture from the air). Corrosive to metal.

Target Organs: Lungs, teeth, eyes, skin.

Potential Health Effects

Eye: Causes severe eye burns. May cause irreversible eye injury. May cause blindness. May cause permanent corneal opacification. The severity of injury depends on the concentration of the solution and the duration of exposure.

Skin: Causes skin burns. The severity of injury depends on the concentration of the solution and the duration of exposure.

Ingestion: May cause severe and permanent damage to the digestive tract. Causes gastrointestinal tract burns.

Inhalation: May cause irritation of the respiratory tract with burning pain in the nose and throat, coughing, wheezing, shortness of breath and pulmonary edema. Causes chemical burns to the respiratory tract. Inhalation

may be fatal as a result of spasm, inflammation, edema of the larynx and bronchi, chemical pneumonitis and pulmonary edema. Because its vapor pressure is negligible, it exists in the air only as a mist or spray. Exposure may impair lung function and cause mucostasis (reduced mucous clearance).

Chronic: Prolonged or repeated skin contact may cause dermatitis. Prolonged or repeated inhalation may cause nosebleeds, nasal congestion, erosion of the teeth, perforation of the nasal septum, chest pain and bronchitis. Prolonged or repeated eye contact may cause conjunctivitis. Effects may be delayed. Workers chronically exposed to sulfuric acid mists may show various lesions of the skin, tracheobronchitis, stomatitis, conjunctivitis, or gastritis. Occupational exposure to strong inorganic acid mists containing sulfuric acid is carcinogenic to humans.

Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid immediately.

Skin: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid immediately. Wash clothing before reuse.

Ingestion: If swallowed, do NOT induce vomiting. Get medical aid immediately. If victim is fully conscious, give a cupful of water. Never give anything by mouth to an unconscious person.

Inhalation: POISON material. If inhaled, get medical aid immediately. Remove victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Notes to Physician: Monitor arterial blood gases, chest x-ray, and pulmonary function tests if respiratory tract irritation or respiratory depression is evident. Treat dermal irritation or burns with standard topical therapy. Effects may be delayed. Do NOT use sodium bicarbonate in an attempt to neutralize the acid.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Use water spray to keep fire-exposed containers cool. Substance is noncombustible. Contact with water can cause violent liberation of heat and splattering of the material. Contact with metals may evolve flammable hydrogen gas. Runoff from fire control or dilution water may cause pollution. Approach fire from upwind to avoid hazardous vapors and toxic decomposition products. Strong dehydrating agent, which may cause ignition of finely divided materials on contact. Oxides of sulfur may be produced in fire.

Extinguishing Media: Use extinguishing media most appropriate for the surrounding fire. Do NOT get water inside containers. If water is used, care should be taken, since it can generate heat and cause splattering if applied directly to sulfuric acid.

Flash Point: Not applicable.

Autoignition Temperature: Not available.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: 3; Flammability: 0; Instability: 2; Special Hazard: -W-

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Carefully scoop up and place into appropriate disposal container. Provide ventilation. Do not get water inside containers. Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading and contact with water.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Do not allow water to get into the container because of violent reaction. Do not get in eyes, on skin, or on clothing. Keep container tightly closed. Discard contaminated shoes. Use only with adequate ventilation. Do not breathe spray or mist. Do not use with metal spatula or other metal items. Inform laundry personnel of contaminant's hazards.

Storage: Do not store near combustible materials. Keep container closed when not in use. Store in a cool, dry, well-ventilated area away from incompatible substances. Do not store near alkaline substances. Store protected from moisture. Ideally, sulfuric acid should be stored in isolation from all other chemicals in an approved acid or corrosives safety cabinet.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits. Use a corrosion-resistant ventilation system.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Sulfuric acid	0.2 mg/m ³ TWA (thoracic fraction)	1 mg/m ³ TWA 15 mg/m ³ IDLH	1 mg/m ³ TWA

OSHA Vacated PELs: Sulfuric acid: 1 mg/m³ TWA

Personal Protective Equipment

Eyes: Wear chemical splash goggles and face shield.

Skin: Wear neoprene gloves, apron, and/or clothing. Viton gloves are recommended.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance: oily - clear colorless to yellow

Odor: odorless

pH: 0.3 (1N solution)

Vapor Pressure: < 0.001 mm Hg @ 20 deg C

Vapor Density: 3.38 (air=1)

Evaporation Rate: Slower than ether.

Viscosity: 21 mPas @ 25 C

Boiling Point: 290 - 338 deg C

Freezing/Melting Point: 10 deg C

Decomposition Temperature: 340 deg C

Solubility: Soluble with much heat

Specific Gravity/Density: 1.84

Molecular Formula: H₂SO₄

Molecular Weight: 98.07

Section 10 - Stability and Reactivity

Chemical Stability: Sulfuric acid reacts vigorously, violently or explosively with many organic and inorganic chemicals and with water.

Conditions to Avoid: Excess heat, exposure to moist air or water, Note: Use great caution in mixing with water

due to heat evolution that causes explosive spattering. Always add the acid to water, never the reverse..

Incompatibilities with Other Materials: Metals, oxidizing agents, reducing agents, bases, acrylonitrile, chlorates, finely powdered metals, nitrates, perchlorates, permanganates, epichlorohydrin, aniline, carbides, fulminates, picrates, organic materials, flammable liquids.

Hazardous Decomposition Products: Oxides of sulfur.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:

CAS# 7664-93-9: WS5600000

LD50/LC50:

CAS# 7664-93-9:

Draize test, rabbit, eye: 250 ug Severe;
Inhalation, mouse: LC50 = 320 mg/m³/2H;
Inhalation, mouse: LC50 = 320 mg/m³;
Inhalation, rat: LC50 = 510 mg/m³/2H;
Inhalation, rat: LC50 = 510 mg/m³;
Oral, rat: LD50 = 2140 mg/kg;

Carcinogenicity:

CAS# 7664-93-9:

- **ACGIH:** A2 - Suspected Human Carcinogen (contained in strong inorganic acid mists)
- **California:** carcinogen, initial date 3/14/03 (listed as Strong inorganic acid mists containing sulfuric acid).
- **NTP:** Known carcinogen (listed as Strong inorganic acid mists containing s).
- **IARC:** Group 1 carcinogen

Epidemiology: Workers exposed to industrial sulfuric acid mist showed a statistical increase in laryngeal cancer. This suggests a possible relationship between carcinogenesis and inhalation of sulfuric acid mist.

Teratogenicity: Sulfuric acid was not teratogenic in mice and rabbits, but was slightly embryotoxic in rabbits (a minor, rare skeletal variation). The animals were exposed to 5 and 20 mg/m³ for 7 hr/day throughout pregnancy. Slight maternal toxicity was present at the highest dose in both species.

Reproductive Effects: No information found

Mutagenicity: There are no mutagenicity studies specifically of sulfuric acid. However, there are established effects of reduced pH in mutagenicity testing, as would be caused by sulfuric acid. These effects are an artifact of low pH and are not necessarily due to biological effects of sulfuric acid itself.

Neurotoxicity: No information found

Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Fish: Bluegill/Sunfish: 49 mg/L; 48Hr; TLm (tap water @ 20C)

Fish: Bluegill/Sunfish: 24.5 ppm; 48Hr; TLm (fresh water)

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	SULFURIC ACID	SULFURIC ACID
Hazard Class:	8	8
UN Number:	UN1830	UN1830
Packing Group:	II	II

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 7664-93-9 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 7664-93-9: 1000 lb final RQ; 454 kg final RQ

SARA Section 302 Extremely Hazardous Substances

CAS# 7664-93-9: 1000 lb TPQ

SARA Codes

CAS # 7664-93-9: immediate, delayed, reactive.

Section 313

This material contains Sulfuric acid (CAS# 7664-93-9, 90-98%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

CAS# 7664-93-9 is listed as a Hazardous Substance under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 7664-93-9 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains Sulfuric acid, listed as 'Strong inorganic acid mists contain', a chemical known to the state of California to cause cancer.

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

C

Risk Phrases:

R 35 Causes severe burns.

Safety Phrases:

S 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

S 30 Never add water to this product.

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/Protection)

CAS# 7664-93-9: 2

Canada - DSL/NDSL

CAS# 7664-93-9 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A, D1A, E.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 7664-93-9 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 4/22/1999

Revision #15 Date: 2/13/2008

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.



Material Safety Data Sheet Zinc Acetate Solutions

Section 1 - Chemical Product and Company Identification

MSDS Name:

Zinc Acetate Solutions

Catalog Numbers:

LC27080, LC27100

Synonyms:

None

Company Identification:

LabChem Inc
200 William Pitt Way
Pittsburgh, PA 15238

Company Phone Number:

(412) 826-5230

Emergency Phone Number:

(800) 424-9300

CHEMTREC Phone Number:

(800) 424-9300 or
(011) 703-527-3887

Section 2 – Composition, Information on Ingredients

CAS#	Chemical Name:	Percent
7732-18-5	Water	balance
5970-45-6	Zinc acetate, dihydrate	10-22

Section 3 - Hazards Identification

Emergency Overview

Appearance: Clear, colorless solution

Caution. May cause eye irritation.

Target Organs: Eyes.

Potential Health Effects

Eye:

May cause eye irritation.

Skin:

May cause skin irritation.

Ingestion:

May cause irritation of the digestive tract.

Inhalation:

May cause respiratory tract irritation.

Chronic:

Chronic exposure may cause kidney damage.



Material Safety Data Sheet Zinc Acetate Solutions

Section 4 - First Aid Measures

Eyes:

Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin:

Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid.

Ingestion:

Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately.

Inhalation:

Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:

Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.

Extinguishing Media:

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam.

Autoignition Temperature:

No information found.

Flash Point:

No information found.

NFPA Rating:

CAS# 7732-18-5: Health- 0, Flammability- 0, Instability- 0.

CAS# 5970-45-6: Health- 2, Flammability- 1, Instability- 0.

Explosion Limits:

Lower: n/a Upper: n/a

Section 6 - Accidental Release Measures

General Information:

Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Absorb spills with inert absorbent (vermiculite, sand, fuller's earth) and place in suitable containers labeled for later disposal.



Material Safety Data Sheet Zinc Acetate Solutions

Section 7 - Handling and Storage

Handling:

Wash thoroughly after handling. Do not get in eyes, on skin, or on clothing. Do not ingest or inhale.

Storage:

Store capped at room temperature. Protect from heat and incompatibles.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls:

Facilities using or storing this material should be equipped with an eyewash and safety shower.

Provide local exhaust or general dilution ventilation.

Exposure Limits:

Chemical Name:	ACGIH	NIOSH	OSHA
Water	None of the components are on this list	None of the components are on this list	None of the components are on this list
Zinc acetate, dihydrate	None of the components are on this list	None of the components are on this list	None of the components are on this list

OSHA Vacated PELs:

None.

Personal Protective Equipment**Eyes:**

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133. Do not wear contact lenses when working with chemicals.

Skin:

Wear appropriate protective gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

Follow the OSHA respirator regulations found in 29 CFR 1910.134. Always use a NIOSH-approved respirator when necessary.

Section 9 - Physical and Chemical Properties

Physical State:	Clear liquid
Color:	Colorless
Odor:	Slight acetic
pH:	5-7
Vapor Pressure:	No information found.
Vapor Density:	No information found.
Evaporation Rate:	No information found.
Viscosity:	No information found.
Boiling Point:	No information found.
Freezing/Melting Point:	No information found.
Decomposition Temperature:	No information found.
Solubility in water:	Soluble



Material Safety Data Sheet Zinc Acetate Solutions

Specific Gravity/Density: 1.0 – 1.2
Molecular Formula: No information found.
Molecular Weight: No information found.

Section 10 - Stability and Reactivity

Chemical Stability:

Stable under normal temperatures and pressures.

Conditions to Avoid:

Incompatible materials, excess heat.

Incompatibilities with Other Materials:

Strong oxidizing agents.

Hazardous Decomposition Products:

Carbon monoxide, carbon dioxide, zinc oxides.

Hazardous Polymerization:

Has not been reported.

Section 11 - Toxicological Information

RTECS:

CAS# 7732-18-5: ZC0110000.

CAS# 5970-45-6: ZG8750000.

LD50/LC50:

CAS# 7732-18-5:

Oral, rat: LD50 = >90 mL/kg.

CAS# 5970-45-6:

Oral, mouse: LD50 = 287 mg/kg

Oral, rat: LD50 = 794 mg/kg.

Carcinogenicity:

CAS# 7732-18-5: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

CAS# 5970-45-6: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

Epidemiology:

No information found

Teratogenicity:

No information found

Reproductive:

No information found

Mutagenicity:

No information found

Neurotoxicity:

No information found

Section 12 - Ecological Information

No information found



Material Safety Data Sheet Zinc Acetate Solutions

Section 13 - Disposal Considerations

Dispose of in accordance with Federal, State, and local regulations.

Section 14 - Transport Information

US DOT

Shipping Name: Not regulated.

Hazard Class:

UN Number:

Packing Group:

Section 15 - Regulatory Information

US Federal

TSCA:

CAS# 7732-18-5 is listed on the TSCA Inventory.

CAS# 5970-45-6 is not on the TSCA Inventory; however, its anhydrous form is on the inventory and so this hydrate is exempt from TSCA Inventory requirements (40CFR270.3(u)(2)).

SARA Reportable Quantities (RQ):

Zinc Acetate, Anhydrous (CAS No. 557-34-6): 1000 lbs. (453.6 kg)

CERCLA/SARA Section 313:

This material contains Zinc acetate dihydrate (CAS# 5970-45-6, 10-22%), listed as Zinc compounds, which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

OSHA - Highly Hazardous:

None of the components are on this list.

US State

State Right to Know:

Zinc acetate, anhydrous, can be found on the following state Right-to-Know lists: California, New Jersey, Florida, Pennsylvania, Massachusetts.

California Regulations:

None.

European/International Regulations

Canadian DSL/NDL:

CAS# 7732-18-5 is listed on Canada's DSL List.

CAS# 5970-45-6 is listed on Canada's DSL List.

Canada Ingredient Disclosure List:

CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.

CAS# 5970-45-6 is not listed on Canada's Ingredient Disclosure List.



Material Safety Data Sheet Zinc Acetate Solutions

Section 16 - Other Information

MSDS Creation Date: February 14, 1998

Revision Date: February 17, 2011

Information in this MSDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc. assumes no liability resulting from the use of this MSDS. The user must determine suitability of this information for his application.

APPENDIX B

HEALTH AND SAFETY FORMS



TAILGATE SAFETY MEETING

Project Name:	Date:
Project Number:	Time: Start: Stop:
Location:	Sheet: ____ of ____
Presented By:	
Topics Covered:	

I have reviewed the Site Health and Safety Plan for the _____ Site and understand the potential health and safety hazards at this operation and the emergency response procedures. I agree to conduct all on-site work in conformity with the requirements of the Health and Safety Plan.

NAME (print)	SIGNATURE	COMPANY
Safety and Health Concerns Expressed during Meeting:		
Corrective Actions Taken or Planned:		



REAL-TIME MONITORING INSTRUMENT CALIBRATION LOG

Project Name:		Project Number:
Location:		
Instrument (s):		
Model Number(s):		Serial Number(s):
Calibration Gas(es):	Concentration	

DATE	TIME	READING	CALIBRATED BY	COMMENTS



REAL-TIME MONITORING LOG

Date:		Person performing sampling:						
Project Name:		Signature:						
Project No.:								
Time	Monitoring Location (be specific)	READINGS						COMMENTS (Where was sample taken? e.g., breathing zone or other) and Duration of Monitoring
		O ₂ %	LEL %	VOC ppm	Dust mg/ m ³	Noise dB	Detect or Tube (spec. tube)	

Real Time Instrument Calibration Log should accompany this form.

INCIDENT AND INJURY REPORT

This form must be completed and forwarded to Corporate Health and Safety within 24 hours of any incident/injury.
For serious injuries, also complete page 2 and forward the entire form to Corporate Health and Safety by the end of the day.

Employer Name:	
Employer Address:	
Employer Phone #	Employers FAX #

EMPLOYEE		
Name:		Soc. Sec. #
Home Address:		
County:	Zip Code:	
Home Telephone:	Date of Birth:	Age:
Occupation: (Job Title):	Sex: Male <input type="checkbox"/> Female <input type="checkbox"/>	
Department:	Married: Yes <input type="checkbox"/> No <input type="checkbox"/>	
How long employed:	Years	Mo.
No. Children under 18 yrs.		

ACCIDENT/INJURY	
Project Name:	Project Number:
Address of Accident:	
County:	Zip Code:
Was accident on company property: Yes <input type="checkbox"/> No <input type="checkbox"/>	
Date and Time of Injury:	Date Reported:
What was Employee doing when injured? (Be specific – include tools, equipment, materials, or objects involved):	
How did the injury occur? (Describe the event that resulted in injury):	
Body Part injured and nature of injury (Be specific):	
Name of object or substance that directly injured the employee:	

MEDICAL	
First aid given by:	
Date of medical assistance:	Was accident fatal?
Name of medical provider:	
Address of medical provider:	
Diagnosis:	
If hospitalized, name and address of hospital:	
EMPLOYEE'S SIGNATURE:	Date:
PREPARER'S SIGNATURE:	Date:
SUPERVISOR'S SIGNATURE:	Date:
HEALTH & SAFETY SIGNATURE:	Date:



Case # _____

Page 2 of 2

INCIDENT AND INJURY REPORT

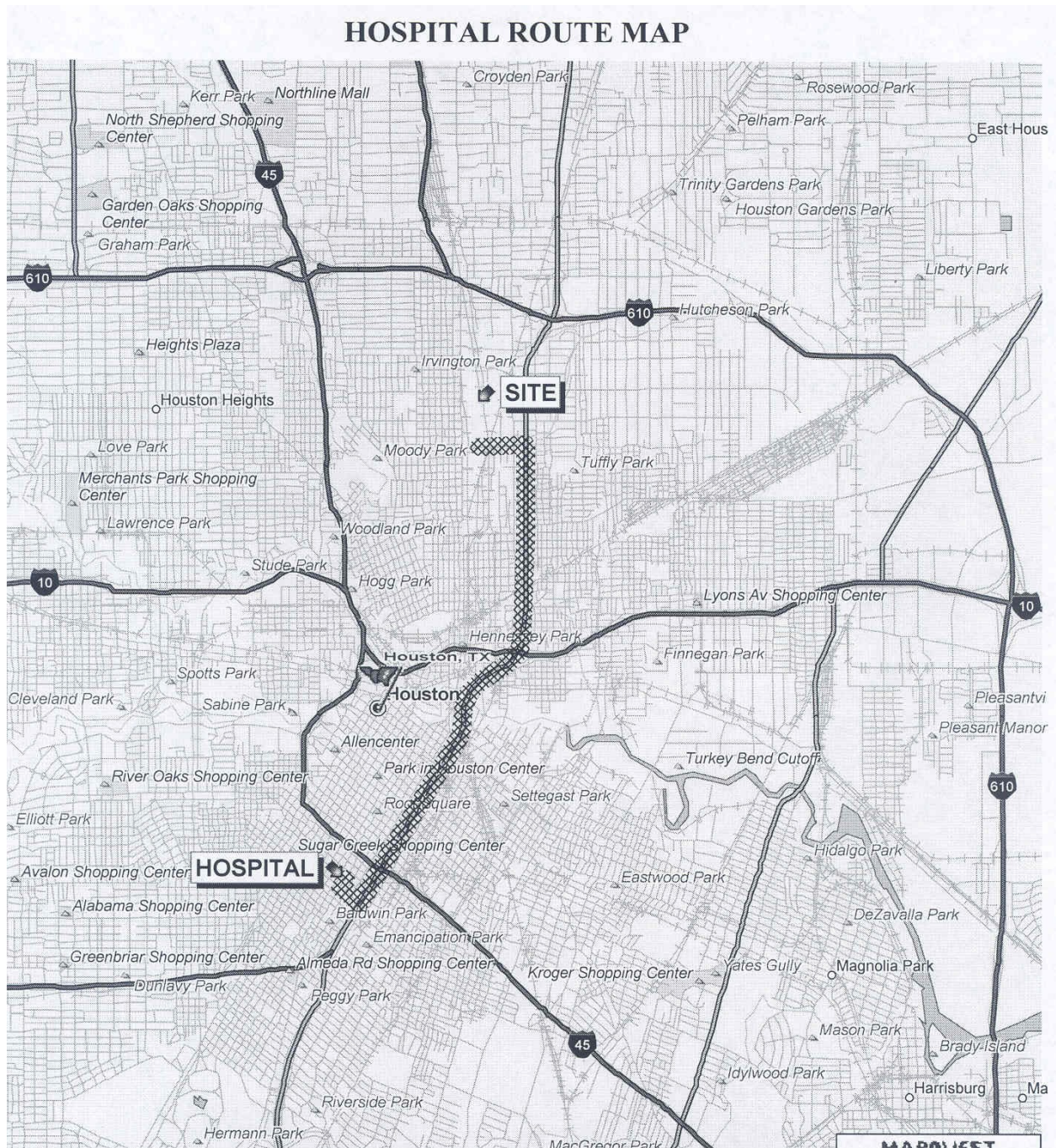
ACCIDENT INVESTIGATION AND FOLLOW-UP	
Provide additional information on what the employee was doing and how the injury occurred:	
Witness names (also addresses and phone numbers if not company personnel):	
What did the employee do or fail to do that caused or contributed to the accident?	
What caused or influenced the unsafe act?	
What condition of tools, equipment or the jobsite caused or contributed to the accident?	
What caused or influenced the unsafe condition?	
What action has been taken or is planned to prevent recurrence?	
Person(s) responsible for completion of the action:	
Target date:	Actual completion date:
Completed by:	

OFFICE USE ONLY	
Case Type: First Aid <input type="checkbox"/> Medical <input type="checkbox"/> Restricted <input type="checkbox"/> Days Away from Work <input type="checkbox"/>	
OSHA Recordable: Yes <input type="checkbox"/> No <input type="checkbox"/>	
Worker's Comp Claim Filed: Yes <input type="checkbox"/> No <input type="checkbox"/>	Date Filed:
Project Manager:	
Date lost work time began:	
Total days away from work:	
Date of restricted activity:	
Total restricted workdays:	
Date returned to full duty:	

APPENDIX C

**EMERGENCY CONTACTS AND
HOSPITAL ROUTE MAP**

EMERGENCY NUMBERS South Cavalcade Superfund Site Houston, Texas	
Fire	911
Police	911
Ambulance	911
Hospital – Christus St. Joseph Hospital	(713) 757-1000
John Francis – Key Environmental Inc. Health & Safety Manager	(412) 279-3363
National Response Center (spill, release reporting)	(800) 424-8802
DIRECTIONS TO EMERGENCY ROOM	
Christus St. Joseph Hospital – (713) 757-1000 1401 St. Joseph Parkway, Houston, TX 77002 Turn left (East) out of Site on Collingsworth St. about ½ mile to Eastex Freeway; Turn right (South) onto Eastex Freeway and merge onto US-59 (ramp in on the left); Travel south on the freeway for about 3.8 miles; Take the McGowen Ave./Taum Ave. exit then stay straight onto Hamilton St.; Turn right onto McGowen St. and go about 4 blocks; then, Turn right onto Crawford St. and then left into the hospital. Total estimated distance is about 5.5 miles. Total estimated time is about 10 minutes.	
UTILITY NUMBERS	
Houston One-Call Center	(800) 669-8344



Christus St. Joseph Hospital – (713) 757-1000 1401 St. Joseph Parkway, Houston, TX 77002

Turn left (East) out of Site on Collingsworth St. about ½ mile to Eastex Freeway;
 Turn right (South) onto Eastex Freeway and merge onto US-59 (ramp in on the left);
 Travel south on the freeway for about 3.8 miles;
 Take the McGowen Ave./Taum Ave. exit then stay straight onto Hamilton St.;
 Turn right onto McGowen St. and go about 4 blocks; then,
 Turn right onto Crawford St. and then left into the hospital.
 Total estimated distance is about 5.5 miles. Total estimated time is about 10 minutes.

ATTACHMENT B
FIELD INFORMATION FORMS

GROUNDWATER SAMPLE COLLECTION RECORD

[illegible]

BORING Field Investigation (2013) Spreadsheet - South Cavalcade, Houston, Texas

Boring Location	Drilling Complete Date	Total Depth	Sand/Silt - Intervals	Clay Intervals	*Core* Depth to Saturation	Impact Obsrvations Product/Sheen/Odor/PID - and Interval	Plugged Yes/No	Temporary Monitor Well - Screen Interval -Depth	Groundwater Sample- Yes/No - Date	Temporary Monitoring Well Abandonment -Date	COMMENTS* Field Observations (e.g. turbidity)



LOG OF BORING: _____

Page ____ of ____

Client Name:	Drilling/Boring Method:	Total Boring Depth (ft):
Project Number:	Sampling Method:	Ground Surface Elev. (ft-msl):
Location:	Subcontractor/Drillers:	Measuring Point Elev. (ft-msl):
Date/Time Started:	Monitoring Equipment:	Geologist/Engineer:
Date/Time Completed:	Coordinates:	Consultant: KEY Environmental, Inc.

ft-bgs	Sample No.	PID (ppm)	Blows/in.	Recovery	SOIL DESCRIPTION (color, texture, moisture, etc.)	Lithology	USCS Classification	Well Construction	ft-bgs
0									0
1									1
2									2
3									3
4									4
5									5
6									6
7									7
8									8
9									9
10									10
11									11
12									12
13									13
14									14

Silt		Gravel	
Clay		Bedrock	
Sand			

NOTES
in - indicates inches
ft - indicates depth in feet
ft-bgs - indicates feet below ground surface
ft-msl - indicates feet above mean sea level
N/A - indicates not applicable to this boring
ppm - indicates parts per million

Signature of Field Supervisor

Date

LOG OF BORING: _____ (con't)

Page ____ of ____

ft-bgs	Sample No.	PID (ppm)	Blows/6-in.	Recovery	SOIL DESCRIPTION (color, texture, moisture, etc.)	Lithology	USCS Classification	Well Construction	ft-bgs
14									14
15									15
16									16
17									17
18									18
19									19
20									20
21									21
22									22
23									23
24									24
25									25
26									26
27									27
28									28
29									29
30									30

Legend:

Silt Gravel

Clay Bedrock

Sand

NOTES

in - indicates inches

ft - indicates depth in feet

ft-bgs - indicates feet below ground surface

ft-msl - indicates feet above mean sea level

N/A - indicates not applicable to this boring

ppm - indicates parts per million

LOG OF BORING: _____ (con't)

Page _____ of _____

ft - bgs	Sample No.	PID (ppm)	Blows/6-in.	Recovery	SOIL DESCRIPTION (color, texture, moisture, etc.)	Lithology	USCS Classification	Well Construction	ft - bgs
30									30
31									31
32									32
33									33
34									34
35									35
36									36
37									37
38									38
39									39
40									40
41									41
42									42
43									43
44									44
45									45
46									46

Legend:

Silt: Gravel:

Clay: Bedrock:

Sand:

NOTES

in - indicates inches

ft - indicates depth in feet

ft-bgs - indicates feet below ground surface

ft-msl - indicates feet above mean sea level

N/A - indicates not applicable to this boring

ppm - indicates parts per million

LOG OF BORING: _____ (con't)

Page _____ of _____

ft-bgs	Sample No.	Hnu (ppm)	Blows/6-in	Recovery	SOIL DESCRIPTION (color, texture, moisture, etc.)	Lithology	USCS Classification	Well Construction	ft-bgs
46									46
47									47
48									48
49									49
50									50
51									51
52									52
53									53
54									54
55									55
56									56
57									57
58									58
59									59
60									60
61									61
62									62

NOTES

in - indicates inches
ft - indicates depth in feet
ft-bgs - indicates feet below ground surface
ft-msl - indicates feet above mean sea level
N/A - indicates not applicable to this boring
ppm - indicates parts per million

Silt

Clay

Sand

Gravel

Bedrock

ATTACHMENT C

**LOW FLOW (MINIMAL DRAWDOWN)
GROUNDWATER SAMPLING
PROCEDURES – SOP 36**

36 - LOW-FLOW (MINIMAL DRAWDOWN) GROUNDWATER SAMPLING PROCEDURES

1.0 SCOPE AND PURPOSE

This standard operating procedure (SOP) provides guidelines for the collection of representative groundwater samples from monitoring wells. Groundwater samples are typically collected from monitoring wells for laboratory analysis to support the characterization of representative groundwater quality. Low-flow purging has the advantages of minimizing the turbidity and mixing between the overlying stagnant casing water and water within the screened interval. Low-flow refers to the velocity with which water enters the pump intake from the formation pore water in the immediate vicinity of the well screen. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. Typically, flow rates on the order of 0.1-0.5 liter/minute are used, however, these flow rates may be varied dependent upon site-specific hydrogeology.

1.1 Referenced SOPs

03 – Field Logbook
22 – Sample Preparation
23 – Sample Handling, Preservation, Packaging and Shipping
24 – Chain of Custody
25 – Equipment Decontamination
26 – Depth to Groundwater and NAPL Measurements
34 – Groundwater Sampling

1.2 Definitions

(Reserved)

2.0 REQUIRED MATERIALS

The following list identifies the types of equipment which may be used during groundwater sampling tasks. Project-specific equipment should be selected based upon project objectives, the depth of groundwater, purge volumes, analytical parameters, and well construction. The types of groundwater sampling equipment are as follows:

- Purging/Sample Collection Equipment
 - Low-flow (e.g., 0.1-0.5 liter/minute) pumps such as peristaltic pumps; bladder pumps, electrical submersible pumps, and gas-driven pumps
 - Pumps are to be constructed of stainless steel or Teflon®

Note that bailers are inappropriate devices for low-flow sampling.

Peristaltic pumps may be the least desirable choice, and for some projects, may not be an option at all. Some regions have specific requirements regarding what type of pumps should be used for sampling of particular analytical parameters. For example, USEPA Region II does not allow the use of peristaltic pumps for collecting samples for analysis of organic parameters. For this reason, region-specific requirements regarding pump selection shall be specified in the project-specific work plan. Another consideration is the soft silicon tubing required for use with the peristaltic pump mechanism. There is potential that this tubing may react with more complex organic compounds.

- Related sampling and field measurement equipment will include some or all of the following:
 - A multi-parameter measurement unit with in-line sampling capability such as a Horiba® U-10 or U-22
 - A photoionization detector (PID) to monitor for volatile organic constituents upon opening the monitoring well cap (the need for this instrument will be specified in the project specific work plan)
 - An in-line dissolved oxygen meter
 - An in-line turbidity meter
 - An in-line filtration apparatus, 0.45 micron, if dissolved metals are a constituent of interest at the site;
 - A water level meter
 - An interface probe, if light non-aqueous phase liquid (NAPL) or dense NAPL are potentially present on site (the need for this instrument will be specified in the project-specific work plan)
- General Equipment:
 - Safety Glasses or equivalent eye protection
 - Distilled water and dispenser bottle
 - Decontamination solutions (such as Alconox™ and solvents)
 - Field data sheets and log book
 - Sample preservation solutions
 - Sample containers
 - Buckets and intermediate containers
 - Coolers
 - Shipping labels
 - Permanent markers/pens
 - Packing tape
 - First aid kit
 - Key(s) for well locks
 - Stopwatch
- Disposable Materials:
 - Plastic sheeting/bags
 - Pump tubing
 - Gloves

- Filters
- Chemical-free paper towels
- Personal protective equipment, if necessary

3.0 METHODOLOGIES

3.1 Pre-Sampling Considerations

Water samples should not be collected immediately following well development. Sufficient time should be allowed for the groundwater flow regime in the vicinity of the monitoring well to stabilize and to approach chemical equilibrium with the well construction materials. This lag time will depend on site conditions and method of installation. New Jersey protocols require a minimum lag time of two weeks. USEPA protocols recommend an evaluation of site conditions with a typical minimum lag time of one week. (Note: Project personnel shall review applicable regulatory guidelines regarding the required lag time on a project-specific basis).

Several preparatory activities need to be completed prior to actual sampling of each well. These preparatory activities can be summarized as follows:

1. Log in sample bottles received from laboratory, prepare any deionized water or preservatives needed for the sampling;
2. If necessary, prepare pumps with standard decontamination procedures;
3. Don the necessary personnel protective equipment (PPE) stipulated in the Site health and safety plan (HASP);
4. Measure static water level prior to well purging. Water levels may be measured to the nearest hundredth of a foot with an electronic probe from the established measuring point of the well casing. If water levels will be used to determine groundwater flow direction and/or hydraulic gradients, all wells should be measured over as short a time period as possible. Water level measurements will be consistent with the procedures specified in *SOP 26 - Depth to Groundwater and NAPL Measurements*.
5. Unless specified otherwise in the project-specific Field Sampling Plan (FSP), well depth should be obtained from the well logs, rather than from measuring total depth, as this activity may disturb material that has settled to the bottom of the well and increase turbidity in samples. If it is necessary to measure total depth, or to measure dense non-aqueous phase liquid (DNAPL), perform these measurements after the sample has been collected.

3.2 Equipment Calibration

Prior to purging and sampling, all sampling devices and monitoring equipment should be calibrated according to manufacturer's recommendations, the site Quality Assurance Project Plan

(QAPP) and the FSP. Dissolved oxygen calibration must be corrected for local barometric pressure readings and elevation.

3.3 Well Purging

For low-flow, minimal drawdown sampling protocols, an in-line water quality measurement device such as a flow-through cell is used to establish the stabilization time on a well-specific basis for several indicator parameters, as follows:

- pH
- Specific conductance
- Dissolved oxygen
- Turbidity
- Oxidation-Reduction Potential (ORP) (as required on a project-specific basis)

This differs from the general guideline used in conventional purging and sampling protocols that requires removal of a minimum of three casing volumes prior to sampling. Following are recommendations to be considered before, during, and after purging and sampling:

- Establish a flow rate that maintains minimal drawdown in the well during both purging and sampling
- Maximize tubing wall thickness and minimize tubing length
- Place the sampling device intake at the middle or slightly above the middle of the screened interval, unless specified otherwise in the project-specific work plan
- For wells completed as open boreholes in bedrock, placement of the sampling device will be specified in the project-specific work plan
- Minimize disturbances of the stagnant water column above the screened interval during water level measurement and sampling device insertion
- Make proper adjustments to stabilize the flow rate as soon as possible
- Monitor water quality indicators during purging

Pump Selection

There are no unusual requirements for groundwater sampling devices when using low-flow, minimal drawdown techniques. The primary requirement is that the device give consistent results and minimal disturbance of the sample across a range of low flow rates (i.e., <0.5 liter/minute). Note that pumping rates that cause minimal to no drawdown in one well could easily cause significant drawdown in another well that has been installed in a less transmissive formation. Consistency in operation is critical to meet accuracy and precision goals.

There are several pumps which are used frequently for purging or sampling. These types include the peristaltic, bladder, and submersible pumps. It is desirable that the pump be easily adjustable and operates reliably at these lower flow rates. Gas-driven pumps should be of a type that does not allow the gas to be in direct contact with the sampled fluid. Bailers and other grab-type samplers are not suited for low-flow sampling and shall not be used.

Bladder Pumps

The bladder pump is a compressed air or gas-operated, positive displacement submersible well pump that uses inert compressed gas, e.g., nitrogen, to inflate an internal bladder which pumps water up the discharge line. These pumps are used when large volumes of water must be purged from monitoring wells or when water depths exceed the limits of a peristaltic pump. Usually these pumps are used on wells with diameters of 2 inches or greater and wells with depths up to 150 feet. When economically feasible the bladder pumps will be dedicated to each well. The line assembly is dedicated for use on one well only. After use, the tubing is wrapped, marked, and stored for future use in the well to which it is dedicated.

The following procedures should be followed for using the bladder pump:

1. Connect the line assembly to the pump by first attaching the cable and then connecting the sample and gas lines.
2. Lower the pump down the well by unrolling the line off the spool until the pump is located at the desired position inside the well.
3. Secure the cable to hold the pump at the desired depth.
4. Connect the gas line to the control box. The discharge line should be connected to the water quality meter or flow-through cell, with cell discharge line placed into a container (e.g., 5-gallon bucket or 55-gallon drum) to collect the purged water.
5. Connect the gas supply to the control box and adjust the pressure according to the manufacturer's manual.
6. As noted, the tubing is used on one well only; after each sampling event it is packed, sealed, and stored for future use on that well.

Submersible Pumps

When wells are encountered which require excessive lift (depth to water is greater than 20 feet) or have diameters greater than 2 inches, positive displacement submersible pumps may also be used to purge the required amount of water. When economically feasible, the submersible pumps will be dedicated to each well. However, in some cases, this is not economically feasible, and the same pump must be used in several wells. When this must be done, the pumps will be appropriately decontaminated between wells. Also, a pump will be used on wells known to contain similar constituent levels, or used first in wells with lower constituent levels before use in wells with historically higher constituent concentrations.

1. The submersible pump should be lowered to the desired depth using a safety line that is secured to the well casing.

2. Connect the power cord to the power source (generator) and turn on the pump.
3. Connect the discharge line to the water quality meter or flow-through cell, with cell discharge line placed into a container (e.g., 5-gallon bucket or 55-gallon drum) to collect the purged water.
4. Continue to monitor the pumping rate and water level in the well, slowing the rate if drawdown occurs.

Peristaltic Pumps

Peristaltic pumps must be operated above ground next to the well and are limited to water level depths of 20 to 30 feet below ground surface. The following procedure describes the use of peristaltic pumps for purging and sample collection.

1. New Nalgene[®] or low density polyethylene (LDPE) suction line is used on each well being purged. New silicone pump head tubing will also be used if the pump is also used for sampling.
2. The type of tubing used to collect the sample will be contingent on the parameters of interest.
 - If conventional parameters (i.e., biological oxygen demand [BOD], total suspended solids [TSS], fecal coliform, pH, and oil and grease) are being analyzed, then standard Nalgene[®] tubing is sufficient to collect the sample.
 - If volatile, semi-volatile, or metals parameters are the constituents of interest, Teflon[®] tubing is used to collect the sample.
3. All tubing is discarded after each use or packed, sealed and stored for future use within the same well.

Unless authorized otherwise, all purged groundwater is collected, containerized, and when possible, managed in an onsite treatment system.

3.4 Monitoring or Water Level and Water Quality Indicator Parameters

Performance criteria for determining stabilization should be based on water-level drawdown, pumping rate, and specifications for indicator parameters. Check the water level periodically during purging and sampling to monitor drawdown in the well as a guide to any necessary flow rate adjustment. The goal is minimal drawdown (<0.1 meter) during purging. This goal may not be possible to achieve under some circumstances and may require adjustment based on site-specific conditions and personal experience.

In-line water quality indicator parameters should be continuously monitored during purging as discussed in *SOP 34 – Groundwater Sampling*, as follows:

- Temperature
- pH
- ORP
- Specific conductivity
- Dissolved oxygen
- Turbidity

Measurements should be taken every three to five minutes. Stabilization is achieved after all parameters have stabilized for three successive readings. The three successive reading should be within the following guidelines to indicate stabilization:

- $\pm 10\%$ for temperature
- ± 0.2 SU for pH
- $\pm 3\%$ for conductivity
- ± 10 mv for ORP
- $\pm 10\%$ for turbidity
- $\pm 10\%$ for dissolved oxygen

Note that these are guidelines only; for example, in those instances where the field parameters measure at very low readings, even minor fluctuations can exceed the guidelines, even though stabilization has been achieved. In these instances, the field technician must use professional judgment to determine that parameter stabilization has been achieved.

Parameters will typically stabilize in the following order: pH, temperature, and specific conductance, followed by ORP, dissolved oxygen, and turbidity. If parameter stabilization criteria are too stringent, then minor oscillations in indicator parameters may cause purging operations to become unnecessarily protracted. It should also be noted that turbidity is a very conservative parameter in terms of stabilization and is normally the last parameter to stabilize. Excessive purge times are invariably related to the establishment of too stringent turbidity stabilization criteria. Note that natural turbidity levels in groundwater may exceed 10 nephelometric units (NTU). Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well.

3.5 Groundwater Sampling

Once parameters have stabilized, begin sample collection as soon as possible. Disconnect or bypass the in-line monitoring device that was used to measure field parameters prior to sample collection. The sampling flow rate should remain at the established purge rate or may be adjusted slightly to minimize aeration, bubble formation, turbulent filling of sample bottles, or loss of volatiles due to extended residence time in tubing. Typically, flow rates <0.5 liters/minute are appropriate. The same device used for purging should be used for sampling. Samples will be collected in decreasing order of their volatility. This order is generally as follows:

- Volatile organic chemicals (VOCs)
- Total organic halogens (TOX)
- Gas sensitive parameters (e.g., Fe^{2+} , CH_4 , $\text{H}_2\text{S}/\text{HS}^-$, alkalinity)
- Total organic carbon (TOC)
- Semivolatile organics chemicals (SVOCs)
- Inorganic parameters

If filtered samples are to be collected, these should be collected last

Samples collected for volatile organics should be carefully placed into 40 milliliter glass vials with Teflon[®] septum lids. No air bubbles should be present in the vial after sealing the septum lid; if air bubbles are present, fill the vial more completely. Other common laboratory-provided sample bottles include polyethylene or clear glass for metals and amber glass for phenols and SVOCs.

If the FSP or QAPP specifies dissolved metals analysis, field filtration of each sample will be necessary. Filtering is performed using an in-line filtration device, hand vacuum pumps with transfer vessels, or peristaltic pumps with disposable filters. If using the vacuum pump method, a laboratory cleaned transfer vessel is used. If using a peristaltic pump, new silicone tubing is used in the pump head for each sample filtered and new Teflon tubing is used from the pump head to the filter. Samples are filtered through 0.45 micron filter unless specified otherwise in the FSP. After filtering, samples requiring preservatives are preserved and all containers are securely placed in coolers and chilled to an appropriate temperature (usually $< 4^\circ\text{C}$). Each cooler containing samples will contain a completed chain-of-custody form.

Sampling technicians should wear a clean pair of disposable gloves for each well.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

Quality control requirements depend upon project-specific circumstances and objectives and should be addressed in the QAPP or FSP.

Quality assurance and quality control for groundwater sampling activities will consist of several distinct elements. Double checking of planned sample numbers versus numbers recorded on the field log sheets, on the sample label, and on the chain-of-custody form shall be completed to ensure that no mix up of samples versus locations occurs. Collection of field quality control samples will be completed as specified in the project planning documents and will typically consist of field duplicate samples, matrix-spike/matrix spike duplicates, and possibly rinsate blanks. Trip blanks and field blanks are typically not required, but may be required on a project-specific basis.

Decontamination of sampling equipment between sample locations is to be performed as outlined in *SOP 25 - Equipment Decontamination*. Sample preparation will follow *SOP 22 - Environmental Sample Preparation*. Sampling handling, preservation, packaging and shipping will follow *SOP 23 - Sample Handling, Preservation, Packaging and Shipping*. Chain of custody will be maintained at all times, following *SOP 24 - Chain of Custody*.

5.0 DOCUMENTATION AND RECORD KEEPING

A written record of each monitoring event must be maintained. The record provides a summary of the sample collection procedures and conditions, shipment method, the analyses requested and the custody history. This record consists of the following:

- Field logbook (*SOP 03 - Field Logbook*)
- Groundwater Sample Collection Forms (Attachment 1)
- Chain of custody forms (*SOP 24 - Chain of Custody*)
- Shipping receipts

Sample labels shall be completed at the time each sample is collected and will include the information listed below.


- Project name
- Sample number
- Time and date
- Preservative (if applicable)
- Analyses to be performed
- Sampler's name

6.0 REFERENCES

U.S. EPA, 1996, Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures: Robert W. Puls and Michael J. Barcelona, EPA/540/S-95/504.

U.S. EPA Region II, Ground Water Sampling Procedure - Low Flow Pump Purging and Sampling.

ATTACHMENT 1
SOP 36 – LOW-FLOW (MINIMAL DRAWDOWN)
GROUNDWATER SAMPLING PROCEDURES
GROUNDWATER SAMPLE COLLECTION RECORD

						WELL NO.: _____													
GROUNDWATER SAMPLE COLLECTION RECORD																			
Project No.: _____ Date: _____ Time: Start: _____ am/pm Project Name: _____ Finish: _____ am/pm Location: _____ Weather Conditions _____ Collector: _____ <div style="text-align: right; font-size: small;"> Print _____ Sign _____ </div>																			
1. WATER LEVEL DATA (measured from top of well casing)						Conversion Factors (cf) (ex cf = f)													
a. Total Casing Length: _____ (ft) b. Well Casing Type: _____ c. Depth to Water: _____ (ft) d. Casing Diameter: _____ (in) e. Length of Water Column: _____ (ft) (a-c) f. Well Volume: _____ (gal)						<table border="1" style="width:100%; border-collapse: collapse; font-size: x-small;"> <thead> <tr> <th style="text-align: center;">Casing I.D. (in)</th> <th style="text-align: center;">Conv. Fact.</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">1</td><td style="text-align: center;">0.041</td></tr> <tr><td style="text-align: center;">2</td><td style="text-align: center;">0.163</td></tr> <tr><td style="text-align: center;">3</td><td style="text-align: center;">0.367</td></tr> <tr><td style="text-align: center;">4</td><td style="text-align: center;">0.653</td></tr> <tr><td style="text-align: center;">6</td><td style="text-align: center;">1.470</td></tr> </tbody> </table>		Casing I.D. (in)	Conv. Fact.	1	0.041	2	0.163	3	0.367	4	0.653	6	1.470
Casing I.D. (in)	Conv. Fact.																		
1	0.041																		
2	0.163																		
3	0.367																		
4	0.653																		
6	1.470																		
2. WELL PURGE DATA																			
a. Purge Method: _____ b. Field Testing Equipment: _____ c. Number of Well Volumes to Remove: _____ d. Required Total Purge Volume (1f x 2c): _____																			
Vol. Purged (total gal)	Temp (°)	pH (s.u.)	Spec. Cond. ()	ORP (mV)	Diss. O ₂ (mg/L)	Turbidity (NTU)													
3. SAMPLE COLLECTION INFORMATION																			
Sampling Method(s): _____																			
Sample Identification (name, time, date): _____																			
QC Samples (name, time, date): _____																			
Analytical Parameters _____																			
and Methods: _____																			
Comments: _____																			

ATTACHMENT D

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

SOUTH CAVALCADE SUPERFUND SITE HOUSTON, TEXAS

Prepared for:

Beazer East, Inc.

Prepared by:

**Key Environmental, Inc.
200 Third Avenue
Carnegie, Pennsylvania 15106**

MAY 2013

QUALITY ASSURANCE PROJECT PLAN

**SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS**

Prepared for:

Beazer East, Inc.

Prepared by:

Key Environmental, Inc.
200 Third Avenue
Carnegie, Pennsylvania 15106

May 2013

Mr. James Zubrow, P.G.
Project Manager
KEY Environmental, Inc.

Ms. Karen Fromme
QA Officer
KEY Environmental, Inc.

Mr. Mike Bollinger
Environmental Manager
Beazer East, Inc.

TABLE OF CONTENTS

SIGNATURE PAGE	i
LIST OF TABLES	iii
LIST OF FIGURES	iii
LIST OF APPENDICES	iii
DISTRIBUTION LIST	iv
LIST OF ABBREVIATIONS/ACRONYMS	v
1.0 PROJECT MANAGEMENT	1-1
1.1 PROJECT ORGANIZATION	1-1
1.2 PROJECT BACKGROUND/ DEFINITION	1-3
1.2.1 Site Description	1-3
1.2.2 Site Groundwater Remedial History	1-4
1.2.3 Project Definition	1-8
1.3 PROJECT DESCRIPTION	1-8
1.4 DATA QUALITY OBJECTIVE PROCESS	1-8
1.4.1 Project Quality Objectives	1-9
1.4.2 Measurement Performance Criteria	1-9
1.5 DOCUMENTATION AND RECORDS	1-13
2.0 MEASUREMENT DATA ACQUISITION	2-1
2.1 SAMPLING PROCESS DESIGN	2-1
2.2 SAMPLING METHODS	2-1
2.3 SAMPLING HANDLING AND CUSTODY	2-1
2.4 ANALYTICAL METHODS AND DETECTION LIMITS	2-1
2.5 QUALITY CONTROL	2-2
2.5.1 Field Quality Control Requirements	2-2
2.5.2 Laboratory Quality Control Requirements	2-3
2.6 EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE	2-4
2.7 INSTRUMENT CALIBRATION AND FREQUENCY	2-5
2.7.1 Field Instrument Calibration	2-5
2.7.2 Laboratory Instrument Calibration	2-6
2.8 DATA ACQUISITION	2-6
2.9 DATA MANAGEMENT	2-6
2.9.1 Data Transmittal, Transformation, and Analysis	2-7
2.9.2 Data Storage and Retrieval	2-7
3.0 ASSESSMENT/OVERSIGHT	3-1
3.1 ASSESSMENT AND RESPONSE ACTIONS	3-1
3.1.1 Technical Systems Audits	3-1
3.1.2 Technical Performance Audits	3-1
3.2 CORRECTIVE ACTION PROTOCOLS	3-2
3.3 REPORTS TO MANAGEMENT	3-3
4.0 DATA VALIDATION AND USABILITY	4-1
4.1 DATA REVIEW, VALIDATION, AND VERIFICATION	4-1
4.1.1 Field Data	4-1
4.1.2 Laboratory Data	4-1

4.2	VALIDATION AND VERIFICATION METHODS.....	4-2
4.3	RECONCILIATION WITH DATA QUALITY OBJECTIVES	4-3
4.3.1	Data Quality Assessment	4-3
5.0	REFERENCES	5-1

LIST OF TABLES

1	SAMPLE COLLECTION SUMMARY
2	ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY

LIST OF FIGURES

1	SITE LOCATION MAP
2	PROJECT ORGANIZATIONAL CHART
3	SITE PLAN

LIST OF APPENDICES

A	KEY STANDARD OPERATING PROCEDURES
B	LABORATORY QUALITY MANUAL

DISTRIBUTION LIST

M. Bollinger - Beazer East, Inc.
R. Josiam - U.S. EPA
M. Long - TCEQ
D. Abshire - EPA
J. Zubrow - Key Environmental, Inc.
M. Valesky - Key Environmental, Inc.
K. Fromme - Key Environmental, Inc.
Laboratory Manager – Test America Laboratories, Inc. - Buffalo

LIST OF ABBREVIATIONS/ACRONYMS

%R	Percent Recovery
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
Beazer	Beazer East, Inc.
Bechtel	Bechtel Environmental, Inc.
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
C	Completeness
CLP	Contract Laboratory Program
COI	Constituent of Interest
Contractor	Key Environmental, Inc.
DNAPL	Dense Non-Aqueous Phase Liquid
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
GC	Gas Chromatograph
GDMVS	Graphical Data Management and Visualization System
GESPMP	Groundwater Extraction System Performance Monitoring Plan
GFTER	Groundwater Fate and Transport Evaluation Report
GIS	Geographic Information System
gpm	gallon per minute
GRAA	Groundwater Remedial Action Area
IDW	Investigation Derived Wastes
KEY	Key Environmental, Inc.
Koppers	Koppers Company, Inc.
LQM	Laboratory Quality Manual
MNA	Monitored Natural Attenuation
NPL	National Priorities List
PAH	Polynuclear Aromatic Hydrocarbon
PID	Photo-ionization Detector
QA/QC	Quality Assurance/Quality Control
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAWP	Remedial Action Work Plan
RD/RA	Remedial Design and Remedial Action
RDWP	Remedial Design Work Plan
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPD	Relative Percent Difference
SAS	Special Analytical Services
Site	South Cavalcade Superfund Site
SOP	Standard Operating Procedure
SOW	Statement of Work
TCEQ	Texas Commission on Environmental Quality

TDWR	Texas Department of Water Resources
TOC	Total Organic Carbon
U.S. EPA	United States Environmental Protection Agency
VGFTER	Verification of Groundwater Fate and Transport Evaluation Report
VOC	Volatile Organic Compound
Workplan	Supplemental Groundwater Characterization Workplan

1.0 PROJECT MANAGEMENT

This Quality Assurance Project Plan (QAPP) has been prepared by Key Environmental, Inc. (KEY) on behalf of Beazer East, Inc. (Beazer) to support the Supplemental Groundwater Characterization Workplan (Workplan) for the South Cavalcade Superfund Site (Site) located in Houston Texas (Figure 1). This QAPP is intended to serve as an integral part of the Workplan. Please refer to the Workplan for a detailed description of the project objectives, scope of work and schedule. This QAPP provides details regarding the analytical methods, data analysis processes, and other procedures to be followed to ensure confidence in the analytical results and to document the validity of the results of the sampling and analysis activities described in the Workplan. Although this QAPP was prepared to support the Workplan, it is the intention of Beazer to update this document as necessary to support any future monitoring activities.

This QAPP satisfies United States Environmental Protection Agency (U.S EPA) requirements for a QAPP, in accordance with the following guidelines:

1. U.S. EPA, "Guidance for the Data Quality Objectives Process," EPA QA/G-4, August 2000;
2. U.S. EPA "EPA Requirements for Quality Assurance Project Plans," EPA QA/R-5, March 2001; and,
3. U.S. EPA "EPA Guidance for Quality Assurance Project Plans," EPA QA/G-5, December 2002.

1.1 PROJECT ORGANIZATION

Beazer will oversee and coordinate the project. KEY, as the Contractor, will be responsible for ensuring that project-specific sampling activities related to the supplemental groundwater characterization investigation are implemented in conformance with the requirements of the Workplan. Those tasks not performed by the Contractor will be completed by a subcontractor under the direct supervision of the Contractor. The Contractor will also perform Quality Assurance/Quality Control (QA/QC) functions for field activities and deliverables. Deliverables will be issued to Beazer by the Contractor for submittal to the U.S. EPA and the Texas Commission on Environmental Quality (TCEQ), as appropriate. The project organizational chart is presented in Figure 2. Test America Laboratories, Inc. (Test America) – Buffalo, located at 10 Hazelwood Dr #106, Amherst, NY, will be the subcontracted laboratory.

The management, technical, and QA/QC responsibilities of the key project personnel for implementation of the future sampling activities are summarized as follows:

- Beazer Project Manager
 - Coordinate project technical activities
 - Conduct project planning activities

- Attend review and planning meetings between Beazer, U.S EPA, and TCEQ, as necessary
- Review all project deliverables
- Oversee the project budget, schedule, and staffing
- Contractor Project Manager
 - Coordinate project technical activities
 - Assist the Beazer Project Coordinator in project planning
 - Attend review and planning meetings between Beazer, U.S EPA, and TCEQ, as necessary
 - Provide technical guidance to field personnel
 - Establish project files
 - Review all project deliverables
 - Manage the project budget, schedule, and staffing
- Contractor Investigation Task Leader
 - Organize and schedule field and laboratory subcontractor activities
 - Ensure that appropriate field documentation is incorporated into the project files
 - Supervise field investigation activities and ensure that the Workplan and QAPP are followed
 - Provide Health and Safety field support
 - Participate in project meetings with Beazer, U.S EPA, and TCEQ, as necessary
 - Prepare project technical reports
- Contractor QA/QC Officer
 - Review laboratory data corrective action, as necessary for quality assurance (QA) compliance
 - Perform or coordinate analytical data validation and review
 - Review laboratory QA/QC
 - Review data validation and review documentation
 - Initiate corrective action, as necessary, for QA compliance
- Laboratory Manager(s):
 - Ensure resources are available on an as-required basis
 - Coordinate analyses and chain of custody
 - Oversee review of data
 - Direct implementation of corrective actions required as a result of data review, internal audits, or external audits (if required)
 - Oversee preparation of analytical reports
 - Approve final analytical reports and case narratives prior to submission to the Contractor

- Analytical Laboratory QA/QC Officer:
 - Review laboratory QA and QC
 - Review QA/QC documentation
 - Investigate project-related nonconformance's
 - Verify resolution of such nonconformance's

Primary responsibility for data quality rests with the Contractor's QA/QC Officer. Ultimate responsibility for project data quality lies with the Contractor's Project Manager. Third level quality assurance will be provided by the analytical laboratory's Project Manager and QA/QC Officer prior to release of data and/or reports to the Contractor.

1.2 PROJECT BACKGROUND/ DEFINITION

Site background information is presented in this subsection; the Site description is discussed in Section 1.2.1 and the Site groundwater remedial history is presented in Section 1.2.2. The project definition is discussed in Section 1.2.3.

1.2.1 Site Description

The following site description is taken verbatim from the Verification of Groundwater Fate and Transport Evaluation Report (VGFTER) (KEY, 2000), except where noted at the end of this Subsection. The South Cavalcade Site occupies approximately 66 acres of urban land approximately three miles north of downtown Houston, Texas. The Site is rectangular in shape with a length of approximately 3,400 feet (in the north-south direction) and a width of approximately 900 feet (in the east-west direction). A Site plan is provided as Figure 3.

The Site was operated as a wood treating plant from 1910 until 1962. Creosote and various metal salts were used in the wood treating processes. The wood treating process area was located in the southern portion of the Site along Collingsworth Street. Koppers Company, Inc. (Koppers) operated the wood treating facility from 1940 until closure in 1962. A coal tar distillation plant was operated by Koppers on the southeastern portion of the Site from about 1944 until 1962. Since the discontinuation of these operations, several trucking firms have occupied the property.

The Site is currently occupied by three trucking firms; thus, much of the ground surface, especially in the southern and northern portions of the Site, is covered by concrete or asphalt pavement, or buildings, as shown on Figure 3. Additionally, Beazer completed the construction of a concrete cap in areas where soil concentrations exceed the remedial goal specified in the U.S. EPA Record of Decision (ROD) (U.S. EPA, 1998) for the Site. The central portion of the Site is currently undeveloped. A groundwater treatment facility is located along the eastern Site boundary in the central portion of the Site. Future use of the Site properties for non-residential purposes is to be expected, because deed restrictions for on-Site properties are in place and the consent agreements between U.S. EPA and the respective property owners prohibit property use for residential purposes. The consent agreements between EPA and the respective property owners also prohibit on-Site groundwater use.

Land use in the vicinity of the Site is a mixture of commercial, industrial and residential. Industrial and commercial properties are located to the east and across Collingsworth Street to the south of the Site. The North Cavalcade Superfund Site, which is also the location of a former wood treating facility, is located directly across Cavalcade Street to the north of the Site. Active rail lines immediately border the Site boundaries to the east and the west. The nearest residences are located several hundred feet to the west of the Site. Note that the Harris County Toll Road Authority (HCTRA) is constructing an extension of the Hardy Toll Road which will border the western Site boundary. As a result, the HCTRA has or is in the process of acquiring the railroad right-of-way and certain residential properties to the west of the Site.

1.2.2 Site Groundwater Remedial History

The following description of the Site groundwater remedial history is taken verbatim from the VGFTER except where noted at the end of this subsection. In 1983, the Houston Metropolitan Transit Authority investigated the Site for potential use in the municipal mass transit system. Results of this investigation indicated localized areas of potential impact and the Site was subsequently referred to the Texas Department of Water Resources (TDWR). In April 1984, TDWR recommended to U.S. EPA that the Site be placed on the National Priorities List (NPL). In October 1984, U.S. EPA proposed that the Site be added to the NPL. The Site was formally included on the NPL in June 1986.

In March 1985, Koppers entered into an Administrative Order on Consent (AOC) to conduct a Remedial Investigation/Feasibility Study (RI/FS) at the Site. The RI/FS was completed by Koppers in August 1988. Remedial Investigation (Keystone Environmental Resources, July 1988) and Feasibility Study Reports (Keystone Environmental Resources, August 1988) were submitted to U.S. EPA.

A ROD was subsequently issued by U.S. EPA in September 1988 which presented the selected remedial alternatives for Site soil and groundwater. The selected remedial alternative for groundwater included extraction and treatment of groundwater containing constituent concentrations greater than the remedial goals specified in the ROD. The ROD stipulated that “groundwater collection will continue until constituents have been recovered to the maximum extent possible”, as “determined during the Remedial Action, based upon experience in operating the groundwater collection and treatment system.” The ROD specified that once U.S. EPA had determined that groundwater constituents have been recovered to the maximum extent possible, groundwater collection would cease and any remaining constituents would be allowed to naturally attenuate to background levels. The ROD also indicated that the groundwater could be remediated via in situ biological treatment if equal performance was demonstrated.

A Detailed Statement of Work for the South Cavalcade Site (SOW) was completed by Bechtel Environmental, Inc. (Bechtel) on behalf of Beazer in May 1990. The SOW described the remedial design and remedial action (RD/RA) activities to be performed by Beazer including pilot study tasks to support the design of the selected remedies. In March 1991, Beazer entered into a Consent Decree with U.S. EPA for implementation of the RD/RA activities specified in the SOW. The SOW was subsequently incorporated into the U.S. EPA-approved Remedial Design Work Plan (RDWP) prepared by Bechtel on behalf of Beazer, dated March 1992.

Tasks conducted to support the groundwater remedial design included groundwater collection well, groundwater recovery trench, and groundwater treatment system pilot studies. Pilot study tasks were completed in October 1993. A 100% Design Groundwater Collection and Reinjection System and Dense Non-Aqueous Phase Liquid (DNAPL) Recovery System Report was prepared by McLaren/Hart Environmental Engineering Corporation on behalf of Beazer. The design report was submitted to U.S. EPA in December 1994, and was subsequently approved.

Implementation of the groundwater remedial action was initiated in June 1995 in accordance with a U.S. EPA-approved Remedial Action Work Plan (RAWP) dated May 1995 and associated support documents. One DNAPL recovery well (RWN-4) and four groundwater collection wells (RWN-1, RWN-2, RWN-3 and RWN-5) were installed within Groundwater Remedial Action Area (GRAA) 1 located in the north section of the Site. One DNAPL recovery well (RWS-5) and three groundwater collection wells (RWS-3, RWS-4, and RWS-6) were installed within GRAA 2, which includes the area formerly occupied by the coal tar distillation plant. Two combined groundwater collection/DNAPL recovery wells (RWS-1 and RWS-2) were installed within GRAA 3, which includes the area formerly occupied by the wood treating process area.

Start-up of the groundwater collection and DNAPL recovery components of the groundwater remedy was conducted in September 1995, following completion of the groundwater treatment plant modifications. In an U.S. EPA letter dated October 6, 1995, U.S. EPA indicated that “there is some question as to whether U.S. EPA will continue to apply the current remedial action goals [i.e., the remedial goals specified in the ROD issued in 1988] to groundwater cleanup.” This direction was taken in response to a July 31, 1995 U.S. EPA memorandum directing a policy favoring applicable and relevant and appropriate requirement (ARAR) waivers at sites where it is technically impracticable to remediate groundwater to Federal or State standards. As provided by the October 6, 1995 U.S. EPA letter and in accordance with an agreement between U.S. EPA and Beazer, groundwater collection and treatment has been delayed pending determination of the potential inapplicability of the groundwater remedial goals specified in the ROD. Operation of the DNAPL recovery component of the groundwater remedy is currently ongoing.

DNAPL recovery operations were conducted in conjunction with groundwater pumping during November and December 1995 as start-up of the groundwater treatment system was completed. In January 1996, operation of the DNAPL recovery system in the passive mode of operation (i.e. collection of DNAPL without groundwater pumping to increase hydraulic gradients) was initiated in accordance with the U.S. EPA-approved 100% Remedial Design. Evaluation of the DNAPL recovery data collected through June 1996 in accordance with the statistical protocol (i.e., zero-slope analysis) specified in the Groundwater Extraction System Performance Monitoring Plan (GESPMP) indicated that DNAPL had been recovered to the “maximum extent possible” under the passive mode of operation.

As a result and in accordance with the U.S. EPA-approved 100% Remedial Design, DNAPL recovery, with groundwater extraction to enhance hydraulic gradients, was initiated in one GRAA (GRAA 3) to evaluate the effectiveness and practicability of this enhancement prior to its use in the other GRAAs. Evaluation of the DNAPL recovery data collected in GRAA 3 from July through September 1996 indicated that groundwater extraction (at a pumping rate of 0.3

gallons per minute [gpm] from individual recovery wells) appeared to enhance DNAPL recovery in Wells RWS-1 and RWS-2. Based on this observation, DNAPL recovery with groundwater extraction to enhance hydraulic gradients was initiated in GRAAs 1 and 2 in October 1996. Beazer continues operation of the DNAPL Recovery System in the gradient enhanced mode, in accordance with the U.S. EPA-approved RAWP and applicable U.S. EPA Guidance, such as the Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration.

In addition to the ongoing DNAPL recovery operation, Beazer has been conducting annual groundwater monitoring since March 1993 in two deeper monitoring wells located in the vicinity of the Site, as stipulated in the ROD. This activity is independent of the natural attenuation assessment for shallow groundwater and is subject only to the applicable provisions of the ROD and U.S. EPA approved RDWP. The results of this monitoring show that the deeper groundwater beneath the Site has not been impacted.

On August 5, 1997, Beazer submitted a revised Groundwater Fate and Transport Evaluation Report (GFTER) to the U.S. EPA for review and approval. The GFTER presented the results of analytical groundwater fate and transport modeling conducted using existing data, where possible, and information from published technical literature as protective default values where Site-specific data were not available. The fate and transport modeling presented in the GFTER was completed by Beazer as a preliminary evaluation of whether natural attenuation processes are sufficient to meet the remedial objectives for shallow groundwater at the South Cavalcade Site. The results of the GFTER supported a preliminary hypothesis that effective natural attenuation of dissolved organic constituents of interest (COI) may be occurring in the shallow groundwater zone at the Site. The GFTER was approved by the U.S. EPA on August 14, 1997.

On July 31, 2000, Beazer submitted a VGFTER to the U.S. EPA. The VGFTER was conducted pursuant to the Work Plan for Verification of the Groundwater Fate and Transport Evaluation which was reviewed and approved by the U.S. EPA. The VGFTER also describes and incorporates supplemental data collection activities that were conducted in response to the results from implementing the approved VGFTER Work Plan. The scope of the supplemental activities was communicated to U.S. EPA by letter dated March 21, 2000. The results of the VGFTER supported the conclusion that a Monitored Natural Attenuation (MNA) remedy is feasible for dissolved phase COIs in shallow groundwater at the South Cavalcade Site.

On March 1, 2006, Beazer submitted a Supplemental Site Characterization Report to the U.S. EPA. This investigation was conducted in accordance with the Supplemental Site Characterization Work Plan submitted and approved by EPA and TCEQ on August 17, 2005. Results indicate that significant constituent migration is not occurring with the targeted potential migration pathways in the shallow and intermediate zone.

From 2006 through 2011, Beazer completed a number of studies related to the applicability of the groundwater remedy specified in the ROD. These studies included a Focused Feasibility Study and FFS Addendum; Technical Impracticability Demonstration Report and a Technical Memorandum on the Evaluation of Natural Attenuation at the Site. The conclusions of these related studies were:

- Natural attenuation is occurring and the groundwater plumes are stable and receding;
- Continued efforts to remove DNAPL from the Site will not result in a significant reduction in risk; and,
- A TI Waiver of groundwater remedial goals is appropriate.

In March of 2011, Beazer conducted a site-wide round of groundwater sampling and analysis. The results of this sampling event showed that the extent and concentrations of constituents in groundwater have not increased. In addition, the following observations were made:

- With the exception of one piezometer (PZS-20), no DNAPL was observed to have accumulated (beyond traces) in any of the wells which is consistent with prior observations that very little recoverable DNAPL exists at the Site; and,
- Concentrations of constituents of interest are generally declining; the north and south plumes appear to be stable or decreasing in size and concentration.

On December 19, 2012, Beazer submitted a Soil Investigation Report to the U.S. EPA. The soil investigation was conducted in support of ongoing discussions with the U.S. EPA and TCEQ regarding an appropriate groundwater remedy for the Site. As part of these discussions, multiple supporting technical documents were submitted: a Technical Impracticability Demonstration Report (March 2001), a Natural Attenuation Evaluation Technical Memorandum (March 2001), and a Focused Feasibility Study (April 2011). These documents were reviewed by the agencies, and in response to comments, additional screening of technologies was completed as documented in a Draft Source Control (DNAPL) Technology Screening Summary (August 2011). A meeting and Site visit with the EPA and TCEQ was subsequently held on December 14, 2011. As a result of the Site visit EPA determined that a TI Waiver and MNA remedy was appropriate for the southern section of the Site but requested that an addendum to the Focused Feasibility Study to evaluate two additional technologies be prepared for the Northern Area. A Draft Focused Feasibility Study Addendum which evaluated two in situ treatment technologies was subsequently submitted (April 2012). Pursuant to review of the addendum, the EPA requested that additional study of the Northern Area be completed via a boring program to determine if sufficient source mass was present that would warrant implementation of an active remedy. Additional objectives of the soil boring program were to verify the nomenclature used during previous Site investigations to describe visual observations of potential impacts in soil and to refine the understanding of the occurrence and distribution of DNAPL in the northern part of the Site.

The soil investigation was conducted in accordance with a September 14, 2012 work plan submitted by Key Environmental, Inc. (KEY) on behalf of Beazer to the EPA and the TCEQ. By email from EPA dated September 17, 2012, EPA indicated that TCEQ and EPA were in agreement with the scope of work presented in the September 14, 2012 Work Plan.

The results of the soil investigation indicate that free phase DNAPL in the northern area was only observed in the vicinity of well RWN-4 where DNAPL has been recovered in the past and in two borings at the eastern border of the property. Without exception, DNAPL, where present

in these areas, was observed in discreet and dispersed thin lenses and streaks within the coarser grained non-cohesive sediments. No evidence of pooled DNAPL was observed. The data obtained from this investigation indicate that no areas exist where targeted treatment would provide commensurate benefit. Hence, the conclusions of the Focused Feasibility Study and Focused Feasibility Study Addendum remain valid.

1.2.3 Project Definition

The Work Plan, which this QAPP supports, presents the scope of work to support the definition of the limits of the TI Zones at the Site. The data acquired through implementation of this workplan will also be used in support of the preparation of the Proposed Plan and ROD Amendment, and in the development of a proposed future groundwater monitoring program. The approach to attaining the stated objectives involve the development of a comprehensive “snapshot” of the current nature and extent of COIs in groundwater. The snapshot of current conditions will be obtained through the installation and sampling of several temporary monitoring wells, located predominantly along inferred preliminary TI Zone boundaries, concurrent with the sampling of existing monitoring wells and piezometers. This QAPP is intended to serve as an integral part of the Work Plan. Please refer to the Work Plan for a detailed description of the project objectives, scope of work and schedule.

The scope of the investigation proposed herein was developed through collaborative efforts of representatives of Beazer, EPA and TCEQ. The development of the scope of the investigation was initiated during the aforementioned April 9, 2013 meeting and was finalized during two subsequent conference calls among the parties on April 10, 2013 and April 19, 2013. During the April 19, 2013 conference call, EPA requested that Beazer prepare a brief workplan describing the scope of the investigation and the methodologies to be utilized for its implementation. This workplan was prepared in response to the EPA request. The specific objectives of the planned site characterization activities are outlined in the subsection 1.4.

1.3 PROJECT DESCRIPTION

The Workplan describes the investigation procedures necessary for additional delineation of the horizontal and vertical extent of constituents of interest (COI) in the shallow and intermediate groundwater-bearing zones at the South Cavalcade Superfund Site located in Houston Texas (Figure 1). Section 2.0 of the Workplan describes the scope of the TI Zone delineation investigation, the methodologies to be used for its implementation, and the chemical parameters that will be evaluated, in detail. Table 1 of this QAPP summarizes the sampling methods and parameters to be analyzed during each investigative task outlined in Section 2.0 of the Workplan. Table 2 of this QAPP presents the matrix sample summary, QC sample summary, and analytical requirements summary for each investigative task.

1.4 DATA QUALITY OBJECTIVE PROCESS

The Data Quality Objective (DQO) process specifies the appropriate amount and type of data required, and establishes tolerable levels of uncertainty for the environmental decisions to be made. U.S. EPA has developed a systematic process for developing DQOs that includes

consideration of several critical elements. The process requires definition of the problem and statement of the decisions that will be made based on study results. The users of the data and key personnel and their roles in the program are identified, as are any regulatory criteria or agencies that will be involved. Information needed to support these decisions can then be determined, including what the COIs are and physical boundaries of the study area, the quantity of data that will be needed, the means to collect these data and the level of uncertainty that will be acceptable. Program design can then be optimized to collect defensible data in the most efficient manner.

For the investigation described in the Workplan, the project objectives are as follows:

- To provide additional and current data to support the definition of the limits of the TI Zones;
- To provide data to support the preparation of the Proposed Plan and ROD Amendment; and,
- To provide data to support the development of a proposed future groundwater monitoring program.

1.4.1 Project Quality Objectives

This QAPP serves as a controlling mechanism during the supplemental groundwater characterization investigation to provide procedures which, when followed properly, will assure that all decisions based on laboratory and field data generated during this investigation are technically sound and properly documented. Specific procedures for sampling, laboratory analyses, data reporting, and data validation, are presented in other sections of this QAPP.

1.4.2 Measurement Performance Criteria

As a result of the varying nature of the data required, there are several applicable levels of data quality for the Workplan. A primary component of data quality is selection of the appropriate analytical level for the intended data use. Analytical levels, as described in “Data Quality Objectives for Remedial Response Activities” (U.S. EPA, March 1987), are as follows:

- Level I - Field screening or analysis using portable instruments. Results are often not compound-specific and not quantitative, but are available in real-time. Level I data are appropriate for initial field screening and for health and safety monitoring. They are frequently used to determine sample collection locations for laboratory analyses.
- Level II - Field analysis using more sophisticated portable analytical instruments; in some cases, the instruments may be set up in a mobile laboratory on location. There is a wide range in the quality of data that can be generated that is dependent on the use of suitable calibration standards, reference materials and sample preparation equipment. Results are available in real-time or within several hours.

- Level III - All analyses are performed in an off-site analytical laboratory. Level III provides quantitative data. Documented sampling and analysis procedures must be used. Level III analyses may or may not use Contract Laboratory Program (CLP) procedures, but at a minimum, abbreviated CLP-type deliverables are required. Level III requires QA/QC procedures conducted in accordance with U.S. EPA guidelines. The laboratory may or may not be a CLP laboratory.
- Level IV – CLP-equivalent routine analytical services. All analyses are performed in an off-site analytical laboratory following CLP protocols. Level IV is characterized by rigorous QA/QC protocols and documentation with full validation of all data.
- Level V - Analysis by nonstandard methods. All analyses are performed in an off-site laboratory that may or may not be a CLP laboratory. Method development or method modification may be required for specific constituents or detection limits. CLP Special Analytical Services (SAS) are Level V.

Level I will be used for the screening activities required for the Workplan, specifically this includes screening data for volatile organic compounds (VOCs) measured with a photo-ionization detector (PID) and field water quality parameters (e.g. pH, conductivity, dissolved oxygen, and temperature). It is anticipated that all laboratory analytical services for the scope of work presented in the Workplan will be Level III.

Each of these levels is characterized by statistically based criteria expressed in terms of:

- Precision;
- Accuracy;
- Representativeness;
- Completeness;
- Comparability; and,
- Sensitivity.

These parameters are discussed in the following six subsections.

1.4.2.1 Precision

Precision is defined as the degree of agreement between repeated measurements of the same parameter under prescribed, similar conditions. Field and laboratory precision will be monitored using results from duplicate sample analyses. Precision can then be expressed as the relative percent difference (RPD) of one result with another. The RPD is calculated as follows:

$$RPD = \frac{D1 - D2}{\frac{(D1 + D2)}{2}} \times 100$$

Where: RPD = relative percent difference

D1 = first duplicate value
D2 = second duplicate value.

The overall DQO for precision of analytical measurements is expressed as a percent of the duplicates having RPDs within established control limits. For the purposes of this project, a RPD of 30% will be used as a benchmark. However, it should be recognized that significant variability in duplicate sample concentrations can occur. Groundwater samples that have the potential for significant interferences or high suspended solids content (e.g. those from temporary wells without sandpicks) may have significant variability in duplicate sample results. When evaluating the RPD results for field duplicate samples, the nature of the samples must be considered and professional judgment must be employed.

The precision of Level I data will be confirmed through repetitive and/or consecutive measurements. The precision of Level III data can be measured through the analysis of field duplicates, laboratory duplicates, and matrix spike duplicates. The frequency of field duplicate collection is specified in Section 2.5.1.1. The frequencies of laboratory duplicate analyses (required for inorganic analyses) and matrix spike/matrix spike duplicate set analyses (required for organic analyses), will be at a minimum of 1 per 20 field samples.

Reproducibility is expressed as a relative percent difference, which is the absolute value of the range between the duplicate results divided by the mean. Acceptable RPDs for each analyte from laboratory and matrix spike duplicates are specified in descriptions of their respective methods. Field duplicate precision criteria for waters are included in data validation guidelines.

1.4.2.2 Accuracy

Accuracy is the measure of the degree of agreement between an analyzed value and the true or accepted value where it is known. Field and laboratory accuracy will be monitored using known concentrations of analytes and surrogates spiked into blanks and selected samples. Accuracy can then be expressed as a percent recovery (%R), which is calculated as follows:

$$\%R = \frac{Qd}{Qa} \times 100$$

Where: %R = percent recovery
Qd = spiked sample result minus the sample result
Qa = spiked amount.

The overall DQO for accuracy is thus the percent of samples that have %R within prescribed control limits.

Accuracy of Level III data can be measured by the analysis of equipment blanks, trip blanks, method blanks, matrix spikes, and surrogate standards. Matrix spikes are samples to which known amounts of target constituents are added. Blanks provide a way of detecting biases introduced in the sampling, sample handling, and analysis.

The frequency of equipment blank and trip blank collection and analysis is specified in Section 2.5.1.1. The frequencies of analyses of method blanks, laboratory control spikes, and matrix spikes, and surrogate standards are specified in the respective methods. The methods also present the acceptable percent recovery limits for each analyte.

1.4.2.3 Representativeness

Representativeness expresses the extent to which the analytical data reflect the actual media at the site and are representative of site conditions and characteristics. Representativeness is a function of the sampling program design and execution and the analytical program. Representativeness from field activities is addressed by collecting an adequate number of samples from optimal locations using standard procedures. The number and location of samples and methodologies of sampling are specified in the Workplan. Representativeness as a function of analytical-method issues may be compromised by method deviations, the presence of potential laboratory or field artifacts, indications of sample non-homogeneity, and recovery anomalies from surrogates or spikes into field samples.

1.4.2.4 Completeness

Completeness (C) is a measure of the amount of valid data obtained from an analytical measurement system. It is expressed as a percent of the overall data that were generated and is calculated as follows:

$$\%C = \frac{V}{T} \times 100$$

Where: %C = percent completeness
V = number of measurements judged valid
T = total number of measurements.

An acceptable percentage of data determined to be valid should be established as target goals for each particular objective. Anything below these goals would require re-sampling and re-analysis or a modification to the goal with justification. As a general rule, the sampling programs will be designed so that program needs will be met if 90% completeness is achieved.

1.4.2.5 Comparability

Comparability is an expression of the confidence with which one data set can be compared against another. Comparability is a qualitative function of the sampling and analysis methods. To assure that one data set can be compared to another, the sampling and analysis methods will follow well-documented standard procedures. The procedures to be used are described in the Workplan.

1.4.2.6 Sensitivity

Sensitivity is the ability of the method to detect the contaminant of concern at the concentration of interest (regulatory clean up standard). Method detection limits and reporting limits for the

analytes of interest are specified in Section 2.4 and are adequately sensitive for the measurement of the constituents at the levels required for this project. QC measures which aid in evaluating sensitivity are field rinsate blanks, trip blanks, and laboratory method blanks. These QC samples are used to ensure that field or laboratory practices do not introduce contaminants, which may positively bias laboratory results. Method reporting limits are set at a level equal to that of the low level standard of the instrument calibration curve.

1.5 DOCUMENTATION AND RECORDS

All records generated during this project will be kept on file by Contractor on behalf of Beazer. These records may include: field log books, field sampling forms, chain of custody forms, laboratory data deliverables, photographs, and other relevant records. These records will be kept in accordance with applicable record retention requirements specified in the Consent Decree.

Revisions and updates to this QAPP will be prepared as Beazer and/or the Contractor deem necessary. A full revision to the QAPP will be prepared if work has not been completed within five years. This will ensure that laboratory changes or method improvements are addressed and that changes to program objectives or scope that may be made as a result of the information gathered in the initial stages are incorporated into the overall program QA/QC. Changes to the QAPP will be documented and signed by Beazer and the Contractor. Document control will be maintained through changing the Revision Numbers and Date in the header of this document.

2.0 MEASUREMENT DATA ACQUISITION

2.1 SAMPLING PROCESS DESIGN

Sampling methods/frequency, laboratory analytical methods/parameters, and QA/QC procedures/frequency are presented in this QAPP. Sampling locations, sampling methods, and sampling frequency are discussed in detail in Section 2.0 of the Workplan. Laboratory analytical parameters for the anticipated sampling and analysis programs will include analysis for the following parameters:

- BTEX as required by the ROD
- PAHs as required by the ROD
- Metal COIs as listed in the ROD

The specific list of parameters associated with each group of monitoring wells is identified on Table 1. Routine analyses will be performed in accordance with laboratory SOPs.

QA/QC samples will be collected and submitted to the laboratory for analysis in accordance with the frequencies discussed in Section 2.5.1.1 of this QAPP.

2.2 SAMPLING METHODS

Sections 2.0 and 3.0 of the Workplan provide detailed information regarding sampling methods, decontamination procedures, and management of investigation derived waste (IDW). Attachment C of the Workplan contains the Standard Operating Procedure (SOP) for low flow purging and sampling.

2.3 SAMPLING HANDLING AND CUSTODY

Included in Appendix A of this QAPP are KEY (SOPs) 03, 22, 23, and 24 which present the sample handling and custody procedures. Section 2.0 of the Workplan also discusses sample handling and custody information.

2.4 ANALYTICAL METHODS AND DETECTION LIMITS

The analytical procedures to be used for this program are presented in Table 2. Detailed information and quality control requirements are provided in the subcontract laboratory's Laboratory Quality Manual (LQM). The subcontract laboratory selected for this QAPP is Test America – Buffalo. The Texas lab certification number for Test America - Buffalo is T104704412-12-3. A copy of Test America - Buffalo's LQM is provided in Appendix B. The Test America laboratory is capable of achieving organic and inorganic analyses detection limits that are suitable for the purpose of the project. A summary of Test America's most recent method detection and reporting limits for U.S. EPA Method SW-846 8260B, 8270CLL, and 6020 is as follows:

COI	MDL (ug/L)	RL (ug/L)
Benzene	0.41	1.0
Ethylbenzene	0.74	1.0
Toluene	0.51	1.0
Xylenes	1.42	3.0
Acenaphthylene	0.056	0.3
Acenaphthene	0.036	0.5
Anthracene	0.034	0.5
Benzo(a)anthracene	0.034	0.3
Benzo(a)pyrene	0.13	0.18
Benzo(b)fluoranthene	0.063	0.3
Benzo(k)fluoranthene	0.07	0.3
Benzo(g,h,i)perylene	0.058	0.5
Chrysene	0.074	0.5
Dibenzo(a,h)anthracene	0.07	0.5
Fluoranthene	0.08	0.5
Fluorene	0.058	0.5
Indeno(1,2,3-cd)pyrene	0.11	0.5
Naphthalene	0.064	1.0
Phenanthrene	0.062	0.2
Pyrene	0.076	0.5
Arsenic	0.078	1.0
Chromium	0.0.07	1.5
Copper	0.22	1.0
Lead	0.069	1.0
Zinc	1.1	10

MDL – Method Detection Limit per most recent Test America – Buffalo study.

RL – Reporting Limit

2.5 QUALITY CONTROL

This section discusses field and laboratory quality control requirements. Laboratory quality control requirements are dictated, in large part, by the analytical methods. Additional aspects of laboratory quality control are discussed in the selected laboratory's LQM.

2.5.1 Field Quality Control Requirements

Quality control in the field will be maintained through equipment calibration (discussed in Section 2.7.1 of this QAPP), measurement reproducibility, and the collection of QC samples.

2.5.1.1 Field Quality Control Samples

Quality control for field sampling efforts will primarily be measured via the collection of field QC samples, which consist of the following:

- Field duplicates;
- Equipment blanks; and,
- Trip blanks.

The data application and sample requirements for each are discussed in the following paragraphs.

Field Duplicates

Field duplicates are used to evaluate the laboratory analytical program for reproducibility of data. One field duplicate for each analysis will be analyzed at a rate of one per every 20 samples.

Field duplicates are collected simultaneously by splitting a sample evenly between the matrix and QC sample bottles. For instance, a groundwater sample bailer would be emptied, in relatively equal volumes, into two sample bottles (one matrix and one QC).

Equipment Blanks

Equipment blank data are used to evaluate field decontamination procedures. Equipment blanks will be collected by pouring analyte-free water, supplied by the analytical laboratory, through decontaminated sample equipment, and then into the sample bottles. Preservation and filtration will be performed as necessary for the appropriate analyses. If disposable equipment is used, the field blank will be taken from a rinse of the equipment prior to sampling use. One field blank per matrix will be sufficient for this project.

Trip Blanks

Trip blank data will be used to evaluate exposure to volatile organic constituents (VOCs) during sampling, shipping and storage at the laboratory. The prepared trip blanks are to be transported with the VOC vials to the field. One set of trip blanks will be included in each cooler containing VOC sample vials and will be analyzed only for the required VOCs.

2.5.2 Laboratory Quality Control Requirements

Quality control data are necessary to determine precision and accuracy of the analyses, and to demonstrate the absence of interferences and contamination of glassware and reagents. Laboratory-generated QC will consist of blanks, replicates, standards, matrix spikes, surrogate spikes and blanks. These will be prepared and analyzed at the method-required frequencies. Method-recommended matrix spiking solutions will be used to determine matrix effects. Surrogates will be added to all samples requiring gas chromatograph (GC) analyses (or as specified in the method). At a minimum, one method blank will be processed for every batch (up to 20 samples) analyzed. Blank samples will be analyzed in order to assess possible contamination and determine which corrective measures may be taken, if necessary.

Laboratory Duplicates

Replicate samples are aliquots of a single sample that are split upon arrival at the laboratory or prior to analysis. Laboratory duplicates are required by methods for inorganic analyses. Since it is anticipated that the concentrations of most organic parameters will be below the laboratory detection limits, precision data on replicate analyses will largely be derived from matrix spike duplicate data. Significant differences between two replicates that are split in a controlled laboratory environment will result in flagging of the affected analytical results.

Surrogate Analysis

Surrogate spike analysis is used to determine the recovery efficiency of analytes in the sample preparation and analysis. Calculated percentage recovery of the spike is used as a measure of the accuracy of the total analytical method. A surrogate spike is prepared by adding to a sample (before extraction) a known amount of pure compound similar to that for which the sample is being analyzed. Surrogate compounds will be added to all samples that are to be analyzed for volatiles including method blanks, duplicate samples, and matrix spikes using the compounds recommended in the respective methods. If a recovery does not fall within these limits, the corrective actions described in the method will be implemented.

Matrix Spike/Matrix Spike Duplicate Analysis

This technique is used to determine the effect of matrix interference on analytical results. Aliquots of the same sample are prepared in the laboratory and each aliquot receives consistent treatment throughout the analytical method. Spikes are added at concentrations specified in the methods. Spike duplicates are prepared for organic analyses. The percent difference between the values of the spike duplicates is taken as a measure of the precision of the analytical method.

Method Blanks

Method blanks will be run for all appropriate analyses to verify that the procedures used do not introduce contaminants that affect the analytical results. The method blank will be prepared by addition of all reagents to a substance of similar matrix as the sample. This blank will then undergo all of the procedures required for sample preparation. The resultant solution will be analyzed with the field samples prepared under identical conditions.

Deviations from the established QC criteria will be noted and reanalysis or other corrective action will be instituted as appropriate for the situation.

2.6 EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Field check summary sheets will be used to identify the most recent maintenance, battery charge, and equipment condition. Routine maintenance procedures will be noted in the field notebooks and may include:

- Removal of surface dirt and debris from exposed surfaces of the field measurement systems;
- Cleansing of the ionization chamber, lamp window, and any filters in a PID; and,
- Daily inspections of sampling equipment and measurement systems for possible problems (i.e., cracked or clogged lines or tubing or weak batteries).

Spare and replacement parts stored in the field to minimize downtime may include:

- Appropriately sized batteries;
- Locks;
- Decontamination supplies;
- Extra sample containers;
- Bailers;
- Bailer line;
- Calibration kit(s), battery charger, and support equipment;
- Health and safety supplies; and,
- Tool kit.

If damaged equipment is identified, it will be replaced by the same or equivalent model as soon as practicable. Field QA activities will be reported to the Contractor Project Manager and QA Officer. Problems encountered during the program affecting quality will be reported. The Project Manager/QA Officer will be responsible for initiating the corrective actions and for ensuring that the actions are taken in a timely manner and that the desired results are produced.

During the course of the corrective actions, the field personnel will be responsible for seeing that field instruments are functioning properly and that work progresses satisfactorily. Additionally, field personnel are responsible for the performance of routine preventive maintenance and QC procedures.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

This section discusses instrument calibration procedures and frequency of calibration. Field instrument calibration is discussed in Section 2.7.1. Laboratory instrument calibration is discussed in Section 2.7.2.

2.7.1 Field Instrument Calibration

Precision and accuracy of field measurements will be maintained in two ways:

- Through daily calibration of each instrument in accordance with the manufacturer's procedures; and,
- By checking the reproducibility of the measurement by obtaining and recording multiple readings.

2.7.1.1 Equipment Requirements

The following field equipment is anticipated for use during the Workplan, for various screening, monitoring, and measurement tasks:

- Electronic groundwater and non-aqueous phase liquid (NAPL) depth measuring devices ;
- PID;
- In Situ groundwater collection method (i.e. Geoprobe® Screen Point Sampler);
- Groundwater sampling pumps such as peristaltic pumps; and,
- Field meters for measuring pH, turbidity, temperature, dissolved oxygen, specific conductance (i.e. Horiba™).

2.7.1.2 Calibration Requirements

All equipment will be calibrated daily for each day of use, or more frequently if necessary. Calibration information is to be recorded on the equipment calibration forms or in the field notebook. If calibration difficulties are experienced for a given piece of equipment, the Contractor or subcontractor responsible for equipment upkeep will replace the equipment with a similar, or equivalent model, as soon as is practicable.

2.7.2 Laboratory Instrument Calibration

Calibration of laboratory equipment will be accomplished according to published procedures associated with specific methods of analysis and U.S. EPA guidance. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing quality control activities. These records will be filed at the location where the work is performed and will be potentially subject to QA audit. For all instruments, the laboratory will maintain a factory-trained repair staff with in-house spare parts, or maintain service contracts with vendors.

2.8 DATA ACQUISITION

Data will be transferred electronically or by computer diskette directly from the laboratory to the Contractor. Once received by the Contractor, data will be reduced and formatted in easily interpreted tables in Excel format. From this format, data will also be electronically transferred into the Contractor's Data Management System.

2.9 DATA MANAGEMENT

The analytical, survey and geological electronic and hardcopy data will be managed and maintained by the Contractor. Any requests for these data by third parties must be first approved by Beazer. Data management for the project has the following objectives:

- Establish a controlled, functional, and efficiently operated data management system and accompanying procedures to manage, analyze, document, and transfer the environmental data that are collected and generated.

- Maintain a usable and accurate database throughout the life of the project.
- Process specific data requests from project and Beazer personnel.
- Transfer specific data components to other parties, as appropriate.
- Archive the database and related documentation upon closure of the project.

2.9.1 Data Transmittal, Transformation, and Analysis

Upon receipt of data from the analytical laboratory, Contractor personnel will ensure that all data packages are complete. If data packages are determined to be incomplete, the laboratory will be contacted and will be required to promptly provide the missing information. Contractor personnel will be responsible for transcribing all data, including electronically transferred data (i.e., electronic data deliverables [EDDs]), into tables suitable for data review. After review and validation, field and laboratory data will be entered into the database with appropriate qualifiers.

Contractor personnel will review Level III data to ascertain that the laboratory has provided the following information:

- Results for all samples submitted;
- Correct reporting units;
- Documentation of acceptable matrix spike duplicate and surrogate recoveries;
- Acceptable standard and preparation blank results; and,
- Appropriate qualifiers of data for which results are reported below the detection limit or for analytes that are also detected in method or preparation blanks.

Tables containing analytical data will be generated through queries from the database and compared against the applicable criteria. Geographic Information System (GIS) data may be used to generate boring logs, groundwater flow maps, and isoconcentration plots.

Geologic data obtained from boring logs, well construction information, and survey coordinates and elevations will also be entered. The data will be reviewed for accuracy and completeness.

Any difficulties originating from the EDD format shall be resolved with the laboratory before the data are imported. Upon importing analytical data, a random sampling will be verified against the associated hard copy data and a copy of the reviewed electronic data printout will be annotated, signed, and retained in the project file.

2.9.2 Data Storage and Retrieval

All electronic data will reside in the Contractor database to be accessed and managed by the Contractor. All records will be maintained by the Contractor until project completion and closeout.

Upon completion of all data review and/or validation, Contractor personnel will prepare data summary tables, as applicable. The Contractor Project Manager is responsible for ensuring that no errors are introduced in data transcription. Both the Contractor Investigation Task Leader and the QA Officer will review and/or check all data tables.

Data not suited to entry into the database will be included or summarized in reports to management, and data reports will be made part of the permanent project file. The Contractor's Project Manager will be responsible for ensuring that all data are included in the permanent project file.

3.0 ASSESSMENT/OVERSIGHT

3.1 ASSESSMENT AND RESPONSE ACTIONS

The assessment and oversight of the project activities may include a process of review and evaluation through systems audits, performance audits, internal peer review, and laboratory oversight. This process will ensure that the QAPP is adhered to, the quality of the data is adequate, and corrective actions, when needed, are implemented effectively and in a timely manner.

3.1.1 Technical Systems Audits

Systems audits performed by the QA/QC Officer or designee may encompass evaluation of QA components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits will be conducted if Beazer requests an unscheduled audit or conditions that may compromise quality are identified. The Systems Audit (if required) will consist of an inspection of the following procedures:

- Sampling
- Sample custody
- Sample storage and preservation
- Sample preparation
- Analytical methodology
- Data management
- Preventive maintenance
- Recordkeeping

3.1.2 Technical Performance Audits

Performance audits may be conducted to determine conformance to the QAPP. As in system audits, unplanned audits may be implemented if requested. Performance audits will be performed after sampling activities commence and the project begins to generate data. These audits document that sampling, custody, and record-keeping in the field are in compliance with applicable requirements of the QAPP.

3.1.2.1 Field Performance Audits

A field performance audit may be conducted at the discretion of the Project Manager to ensure that field personnel are in compliance with the Workplan and applicable SOPs. Each audit shall cover the items necessary to verify proper control of the activities within the defined scope of work. Concerns such as equipment inspections and calibration, personnel training, decontamination, field screening, sample collection, sample shipping and chain-of-custody procedures, and document control are included in a field audit.

The mobilization stage may be audited before work begins to assure that all procedures, training, and materials are in place to support the QAPP. Field activities may be audited during the initial stage to assure compliance with the QAPP. Additional audits may be required depending on the results of these audits. All audits and corrective actions will be reported in writing to the Project Manager.

3.1.2.2 Laboratory Audits

A Texas certified laboratory will be used for this program. If conditions are noted that indicate potential quality issues with analytical results, an audit may be conducted at the recommendation of the QA/QC Officer. This audit shall consist of a general audit and a specific procedure audit. A general audit will be an overview of the whole laboratory from sample receipt to sample disposal. A specific technical audit will be a detailed in depth review of an actual method or procedure.

The findings from any audit conducted will be documented on a laboratory audit record form. Any issues, observations, and findings shall be discussed with the Laboratory Manager. The results of the audit shall be kept on file along with any corrective action taken. If, as a result of the audit, there is uncertainty as to the validity or correctness of a test result, immediate corrective action should be taken and the client notified in writing.

3.2 CORRECTIVE ACTION PROTOCOLS

Project management and staff, including field investigation teams, quality assurance auditors, sample control personnel, and laboratory groups, will monitor ongoing work performance in the normal course of daily responsibilities. When a significant condition adverse to quality is noted at the project location or laboratory, the cause of the condition will be determined and corrective action taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned and taken will be documented and reported to the Project Manager. Implementation of correction action will be verified by documented follow-up action. All project personnel have the responsibility, as part of their normal work duties, to promptly identify and report conditions adverse to quality, and solicit correction. Corrective actions may be initiated under the following (for example):

- When predetermined acceptance standards are not attained (objectives for precision, accuracy, and completeness);
- When procedures or data compiled are determined to be incorrect or incomplete;
- When equipment or instrumentation is found to be malfunctioning;
- When samples and test results cannot be traced with certainty;
- When quality assurance requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits; or,
- As a result of a management assessment.

Corrective actions shall be documented using appropriate field and laboratory forms. All corrective action forms shall be entered into the project files.

3.3 REPORTS TO MANAGEMENT

As needed, progress reports will be prepared by the Contractor, or designate, and submitted to Beazer. Quality assurance reports to management will consist of reports on audits, reports on correction of deficiencies found in audits, a final QA report on field sampling activities, and a final analytical laboratory QA/QC report.

4.0 DATA VALIDATION AND USABILITY

4.1 DATA REVIEW, VALIDATION, AND VERIFICATION

This section discusses data review, validation, and verification. Field data are discussed in Section 4.1.1. Laboratory data are discussed in Section 4.1.2.

4.1.1 Field Data

Field data will be reviewed using four different procedures:

- Routine checks will be made during the processing of data, i.e., looking for errors in identification codes;
- Internal consistency of a data set will be evaluated. This step will involve plotting the data and testing for outliers;
- Checks for consistency of the data set over time will be performed. This can be accomplished by visually comparing data sets against gross upper limits obtained from historical data sets, or by testing for historical consistency. Anomalous data will be identified; and,
- Checks will be made for consistency with parallel data sets; i.e., data sets obtained from the same population (for example, from the same region of the aquifer).

The purpose of these validation checks and tests is to identify outliers; i.e., an observation that does not conform to the pattern established by other observations. Outliers may be the result of transcription errors or instrumentation breakdowns. Outliers may also be manifestations of a greater degree of spatial or temporal variability than expected.

After an outlier has been identified, a decision concerning its factual basis must be made. Obvious mistakes in data will be corrected when possible, and the correct values inserted. If the correct values cannot be obtained, the data may be excluded. An attempt will be made to explain the existence of the outlier. If no plausible explanation can be found for the outlier, it may be excluded, but a note to that effect will be included in the report. Also, an attempt will be made to determine the effect of the outlier with both inclusion and exclusion from the data set.

4.1.2 Laboratory Data

Prior to submitting analytical data to the Contractor, the laboratory must verify compliance to the method requirements. The laboratory will follow their QA/QC manual, SOPs, and this QAPP for all sample analyses. The laboratory will also be responsible for the oversight of the data quality for all analyses. Any sample integrity issues, discrepancies with the chain of custody, or

concerns with the analysis will be addressed and resolved through the Laboratory QA/QC Officer.

All analytical data and calculations shall be reviewed by the laboratory and shall include a minimum of three levels of documented review, including analyst review, peer review and supervisory review. For each level, the review process shall be documented, signed and dated by the reviewer. Each step of this review process shall include the evaluation of data quality based on both the results of the QC data and the professional judgment of those conducting the review. All electronic deliverables must be checked against the hard-copy reports to ensure that the two versions match. Laboratory data will be reported to include the following information:

- Summary and QA/QC narrative;
- Original Chain of Custody form;
- Sample receipt form documenting sample condition;
- Sample results with method reference, dates of sample receipt, preparation, and analysis noted on report form;
- Dilution/concentration factors;
- Sample-specific reporting limits;
- Surrogate recoveries;
- Method blank results linked to field samples;
- Matrix spike results, matrix spike duplicate results, recovery, and precision values;
- Laboratory control sample results;
- Duplicate sample results; and,
- Summaries of initial and continuing calibration analyses.

4.2 VALIDATION AND VERIFICATION METHODS

To ensure the utility of the sample results, a data usability assessment of the analytical data will be completed. This review will be completed by the Contractor's QA/QC Officer. The analytical results generated via SW-846 Method 8260B will be reviewed in accordance with specific critical components of relevant U.S. EPA guidance for data validation. Specifically, analytical results will be reviewed considering the following general rubrics:

- Sample holding time compliance
- Acceptable surrogate spike recoveries
- Laboratory method blank artifacts
- MS/MSD RPDs and recoveries
- Field duplicate RPDs

The analytical results will be reviewed to ensure that samples were analyzed within an acceptable time frame (based on the date of sample collection). Surrogate recoveries will be reviewed to determine if the Gas Chromatography/Mass Spectrometry instrumentation was performing adequately. Method blank results will be reviewed to identify the possibility of laboratory contamination of the samples. The MS/MSD results will provide an indication of the

precision of the analytical method given the potential for matrix interference effects. The field duplicates will be used to document the precision of the sampling process.

The data usability assessment will be completed in accordance with applicable sections of the following guidance document: U.S. EPA's Contract Laboratory Program, National Functional Guidelines for Organic Data Review, and National Functional Guidelines for Inorganic Data Review. As required, this guidance document will be used in conjunction with the laboratory SOPs for the respective analytical methods. Professional judgment will be exercised throughout the data assessment effort, particularly for situations that are not addressed or clearly specified in the SOPs or in the guidance documents.

4.3 RECONCILIATION WITH DATA QUALITY OBJECTIVES

Results from review/validation of field activities and analytical data will be integrated to allow a final reconciliation of achieved data quality with the stated DQOs.

Accuracy, precision, and completeness will be calculated in accordance with the formulas provided in this document. Representativeness will be evaluated based on the implementation of the field sampling program and analytical program with attention paid to evidence of non-homogeneity of samples. Reporting limits will be compared to applicable criteria to evaluate whether adequate sensitivity was achieved. Sampling and analysis methods and results will be reviewed against historical data or data from other related locations to determine comparability.

4.3.1 Data Quality Assessment

The TI Zone Delineation Report will identify any areas of concern where objectives were not met and evaluate the impact of these upon the intended uses of the data. Specific samples or analytes for which the uncertainty exceeds program or project-specific objectives will be identified so that Beazer may make informed decisions on the potential impact to the overall program.

5.0 REFERENCES

- American Public Health Association, Standard Methods for Examination of Water and Wastes, 16th Edition.
- American Society of Agronomy, Inc., Methods of Soil Analysis, Number 9, Part 2, page 570, (Walkley-Black Procedure);
- Beazer, April 2005, Supplemental Groundwater Characterization Workplan, South Cavalcade Superfund Site, Houston, Texas.
- Bechtel Environmental, Inc., May 1990, Detailed Statement of Work for South Cavalcade Site, Houston, Texas.
- Bechtel Environmental, Inc., March 1992, Remedial Design Work Plan, South Cavalcade Site, Houston, Texas.
- Dames and Moore, May 1995, Final Remedial Action Work Plan, South Cavalcade Site, Houston, Texas.
- KEY Environmental, Inc., August 1995, Groundwater Extraction System Performance Monitoring Plan, South Cavalcade Superfund Site, Houston, Texas.
- Key Environmental, Inc., August 1997, Groundwater Fate and Transport Evaluation Report, South Cavalcade Superfund Site, Houston, Texas.
- Key Environmental, Inc., March 21, 2000, Letter from James S. Zubrow to Noel Bennett, P.E. (U.S. EPA).
- Key Environmental, Inc., July 2000, Verification of Groundwater Fate and Transport Evaluation, South Cavalcade Superfund Site, Houston, Texas.
- Key Environmental, Inc., April 2005, Supplemental Groundwater Characterization Workplan, South Cavalcade Superfund Site, Houston, Texas.
- Keystone Environmental Resources, Inc., July 1988, Final Report - Remedial Investigation, South Cavalcade Site, Houston, Texas.
- Keystone Environmental Resources, Inc., August 1988, Feasibility Study , South Cavalcade Site, Houston, Texas.
- McLaren/Hart Environmental Engineering Corporation, December 1994, 100% Design Groundwater Collection and ReInjection System and Dense Non-Aqueous Phase Liquid Recovery System, South Cavalcade Superfund Site, Houston, Texas.

- U.S. EPA, 1983, Methods for Chemical Analysis of Water and Wastes, EPA 600/4-70-020.
- U.S. EPA, 1986, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, as updated and revised.
- U.S. EPA, March 1987, Data Quality Objectives for Remedial Response Activities, OSWER Directive 9355.0-7B.
- U.S. EPA, March 1991, South Cavalcade CERCLA RD/RA Consent Decree, Civil Action No. H-90-2406.
- U.S. EPA, September 1993, Guidance for Evaluating the Technical Impracticability of Groundwater Restoration.
- U.S. EPA, July 31, 1995, Memorandum from Elliot Laws, Assistant Administrator, to Regional Administrators Region I - X Regarding Superfund Groundwater RODs: Implementing Change This Fiscal Year.
- U.S. EPA, October 6, 1995, South Cavalcade Street Superfund Site Groundwater Exposure Assessment Work Plan, September 1996, EPA Review Comments.
- U.S. EPA August 14, 1997, Letter from Glenn Celerier to Mr. Mike Slenska, P.E.
- U.S. EPA, 1998 Record of Decision (ROD) for the South Cavalcade Site.
- U.S. EPA, July 8, 1998, Letter from Glenn Celerier to Mike Bollinger, P.E. (Beazer).
- U.S. EPA, August 2000, Guidance for the Data Quality Objectives Process, EPA QA/G-4.
- U.S. EPA, March 2001, EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5.
- U.S. EPA, December 2002, EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5.
- U.S. EPA, Contract Laboratory Program, National Functional Guidelines for Organic Data Review.
- U.S. EPA, Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review.

TABLES

TABLE 1

**SAMPLE COLLECTION SUMMARY
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS**

Task	Sample Method	Sample Analysis	Analytical Method
Temporary Monitoring Well Sampling	Low Flow Purge and Sampling (See Text of Work Plan)	Field Parameters BTEX PAHs Metal COIs	See Notes SW846 8260B SW846 8270C LL SW846 6020
Existing Monitoring Well and Piezometer Sampling	Low Flow Purge and Sampling (See Text of Work Plan)	Field Parameters BTEX PAHs Metal COIs	See Notes SW846 8260B SW846 8270C LL SW846 6020

Notes:

Methods are from "U.S. EPA, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW846, third ed., as revised and updated.

"Field Parameters" include pH, specific conductance, temperature, dissolved oxygen, oxidation/reduction potential (ORP), and turbidity, as measured by a field instrument, e.g. Horiba™

TABLE 2
ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

Matrix Sample Summary			QC Sample Summary				Analytical Requirements Summary				
Analytical Parameter	Matrix	No. of Samples	Field Duplicates	Equipment Blanks	MS/MSDs	Trip Blanks	Method Reference	Container Type	Required Sample Volume	Preservation	Holding Time
Temporary Monitoring Well Sampling	Water	33	2	1	2	1/trip	8260B	Glass Vials	3- 40mL w/Teflon septum	4°C + HCl	14 Days
							8270C LL	Amber Glass	2-1 liter bottles	None	7 Days to Extraction
							6020	Plastic	500mL	HNO ₃	6 Months
Existing Monitoring Well and Piezometer Sampling	Water	26	2	1	2	1/trip	8260B	Glass Vials	340mL w/Teflon septum	4°C + HCl	14 Days
							8270C LL	Amber Glass	2-1 liter bottles	None	7 Days to Extraction
							6020	Plastic	500mL	HNO ₃	6 Months

Notes:

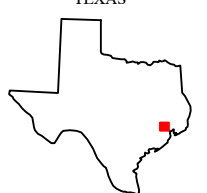
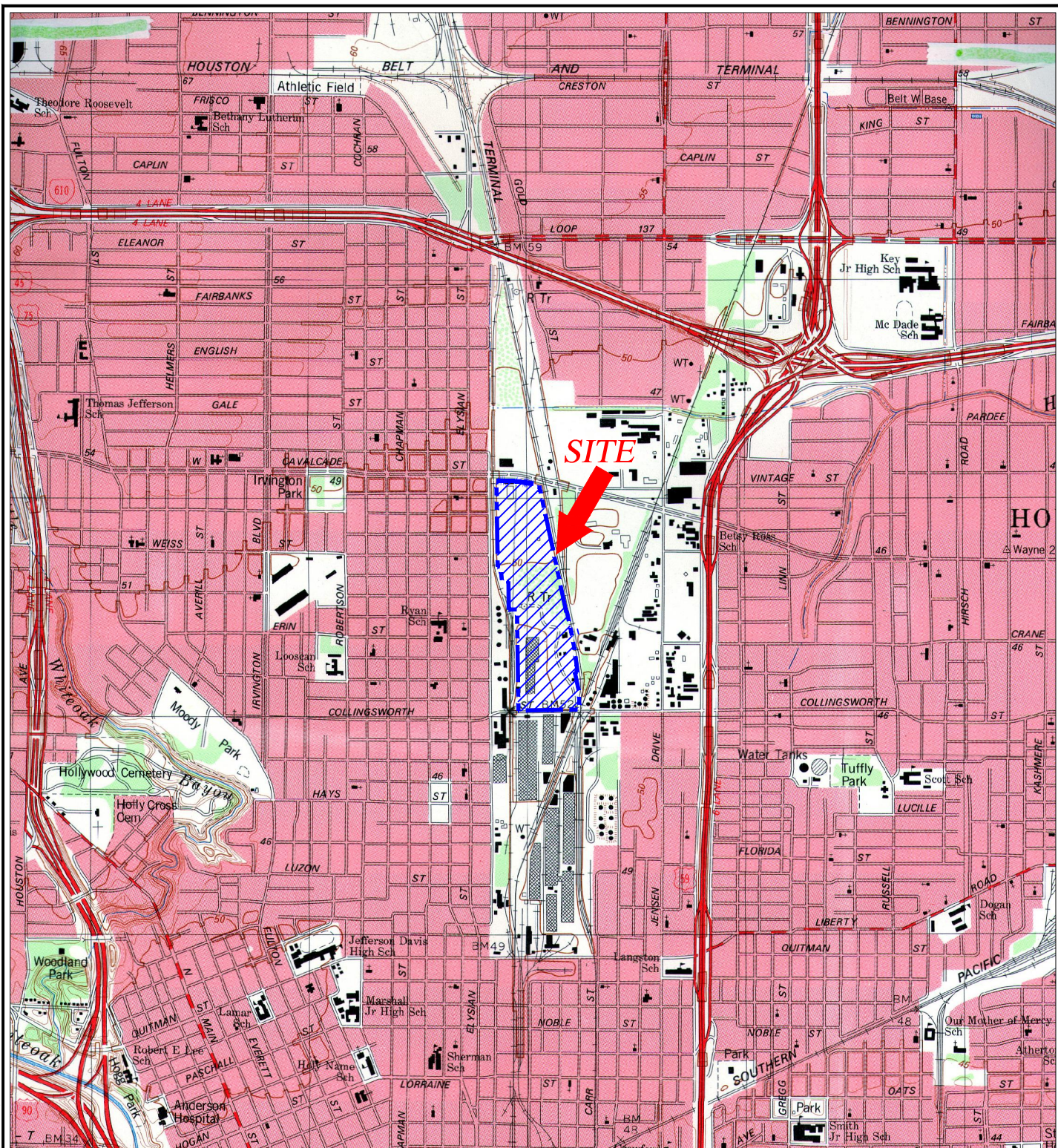
Methods are from "U.S. EPA, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW846, third ed., as revised and updated.

Quality Assurance Project Plan
South Cavalcade Superfund Site
Houston, Texas

Section: Figures
Revision: 2
Date: May 2013

FIGURES

y:\south_cavalade\13-665\quality assurance project plan\figure 1.dwg Last Saved By: Sonner 4/23/2013 4:30 PM Plotted By: Shelly Comer 4/23/2013 4:34 PM Scale: 1:1,0168



QUADRANGLE LOCATION

REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE
OF SETTEGAST, TEXAS - 1982

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

BEAZER EAST, INC
PITTSBURGH, PENNSYLVANIA

DRWN: SCC DATE: 04/23/13
CHKD: BLH DATE: 04/23/13
APPD: JSZ DATE: 04/23/13
SCALE: 1" = 2000'



QUALITY ASSURANCE PROJECT PLAN
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

SITE LOCATION MAP

PROJECT NO: 13-665

FIGURE 1

007522


```
graph TD; A["Beazer Project Manager  
(Mike Bollinger)"] -.- B["U.S. EPA Project Manager"]; A --- C["Contractor Project Manager"]; C -.- D["Project H&S Officer"]; C -.- E["QA Officer"]; C --- F["Site H&S Officer"]; C --- G["Investigation Task Leader"]; C --- H["Project Hydrogeologist/  
Engineer"]; F --- I["Site Geologist, Site H&S Technician, Field Technicians, Technical and Administrative Staff"]; G --- I; H --- I;
```

The organizational chart for the Beazer Project is structured as follows:

- Beazer Project Manager (Mike Bollinger)** is at the top, connected by a dotted line to the **U.S. EPA Project Manager**.
- Below the Beazer Project Manager is the **Contractor Project Manager**, connected by a solid line.
- The Contractor Project Manager is connected by dotted lines to the **Project H&S Officer** (left) and the **QA Officer** (right).
- Below the Contractor Project Manager, a solid line branches to three positions: **Site H&S Officer**, **Investigation Task Leader**, and **Project Hydrogeologist/Engineer**.
- At the bottom, a solid line from the Site H&S Officer, Investigation Task Leader, and Project Hydrogeologist/Engineer all lead to a single box representing the **Site Geologist, Site H&S Technician, Field Technicians, Technical and Administrative Staff**.

Analytical Laboratory	Geoprobe/Drilling	Professional Surveyor	IDW Disposal
-----------------------	-------------------	-----------------------	--------------

y:\south_cavalcade\13-665\quality assurance project plan\figure 3.dwg Last Saved By: Scomer 4/24/2013 8:25 AM Plotted By: Shelly Comer 4/24/2013 8:29 AM Scale: 1:1



LEGEND

- SITE BOUNDARY
- PROPERTY BOUNDARIES
- - - PROPOSED HARDY TOLL ROAD EXTENSION RIGHT-OF-WAY
- [Stippled Pattern] AREAS COVERED WITH ASPHALT OR CONCRETE
- [Hatched Pattern] CONCRETE CAP CONSTRUCTED BY BEAZER



△			
△			
△			
REV #	DATE	DESCRIPTION	APPD

REFERENCE: PROPOSED HARDY TOLL ROAD EXTENSION RIGHT-OF-WAY BASED ON HARDY CONNECTOR SCHEMATIC – FROM: US59/IHIO INTERCHANGE TO: HARDY TOLL ROAD/IHIO610 INTERCHANGE, DANNENBAUM ENGINEERING CORPORATION, 07/24/2009.

ISSUE DATE:

KEY ENVIRONMENTAL, INC.
200 THIRD AVENUE
CARNEGIE, PA 15106

BEAZER EAST, INC.
PITTSBURGH, PENNSYLVANIA

DRWN: SCC	DATE: 04/23/13
CHKD: BLH	DATE: 04/23/13
APPD: JSZ	DATE: 04/23/13
SCALE:	AS SHOWN



QUALITY ASSURANCE PROJECT PLAN
SOUTH CAVALCADE SUPERFUND SITE
HOUSTON, TEXAS

SITE PLAN

PROJECT NO: 13-665
FIGURE 3

*Quality Assurance Project Plan
South Cavalcade Superfund Site
Houston, Texas*

*Section: Appendix A
Revision: 2
Date: May 2013*

APPENDIX A

KEY STANDARD OPERATING PROCEDURES

03 - FIELD LOGBOOK

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) establishes the requirements of the entry of information into logbooks to ensure that KEY field activities are properly documented. Field logbooks are the primary source of documentation for site activities, and serve as legal record of all occurrences during those activities. The project manager and the field team leader are responsible for ensuring the logbook entries provide sufficient information for the completion of an accurate and detailed description of field operations.

Complete and accurate logbook entries are essential to

- Ensure that data collection associated with field activities is sufficient to support the successful completion of the project
- Provide sufficient information that someone not affiliated with the project can independently reconstruct the field activities at a later date
- Maintain quality control throughout the project
- Document changes to or deviations from the Work Plan
- Fulfill administrative needs of a project
- Support potential legal proceedings associated with a specific project

1.1 Referenced SOPs

None

1.2 Definitions

(Reserved)

2.0 REQUIRED MATERIALS

The required materials for maintaining a field log book include a water-resistant, permanently bound notebook (such as *Rite in the Rain ALL-WEATHER ENVIRONMENTAL No. 550F* notebook (or equivalent) and a pen with permanent ink.

3.0 METHODOLOGIES

Pertinent information regarding the site and work procedures must be documented. Information recorded in the notebook should be noted with the date and time of entry. Each field crew shall maintain a single logbook. Legibility must be maintained. The following items are commonly included as logbook entries:

- Name and location of site
- Date and time of arrival and departure
- Name and affiliation of person keeping log
- Names and affiliations of project personnel present on site
- Sampling event description; including methodology, sample numbers and volumes, description of samples, date and time of sample collection, and name of collector
- Prevailing weather conditions and weather delays
- Technical measurements and readings, with notation of anomalous measurements
- Record of phone calls/and or contact with individuals at the site
- Record of approval of field changes to the scope of work
- Diagrams and sketches as needed to document sample locations
- Physical obstructions encountered during field activities
- Reference to global positioning system data collected, if applicable
- Description of equipment used
- Equipment problems encountered and resolution of such problems
- Management or disposal of investigation-derived wastes
- List and descriptions of photographs including camera used, photographer's name, and the direction or view angle of the photograph
- Equipment calibration information

Information should be recorded in permanent ink for the legal record. The company name, address, and phone number should be entered at the beginning of the log book. The title page should also include the start/finish dates for the activity, and whether more than one logbook is included in the record (e.g., Book __ of __). The pages of the logbook should be numbered for ease of reference. Blank spaces should be crossed out and initialed. No pages may be removed from the logbook for any reason.

All notes should be written at the time of observation. If this is not possible, the logbook should indicate when the observations were recorded and the reason for the delay. Changes or deletions should be crossed out with a single line and initialed by the individual making the change.

At the end of each field day, the project scientist/engineer or designee should sign and date each page of the notebook on which entries were made to verify the day's activities. Unused lines at the end of each day's work shall be marked with a diagonal line, signed and dated. The field team leader (or designee) must also sign and date the final daily entry page of each field crew member maintaining a separate logbook. Each day's work shall be recorded starting on a new page, with the date, time, weather conditions, and team members present.

On at least a weekly basis, completed pages must be copied to the project files on the office served so that the loss or accidental destruction of the logbook will result in a minimal loss of data. Copies shall be reviewed to ensure that they are legible.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

At the end of each day of field activities, the individual or individuals maintaining the field logbook should review the notes for accuracy and completeness. Corrections, deletions, or additions should be stricken, initialed and dated.

5.0 DOCUMENTATION AND RECORD KEEPING

The first page of all field logbooks must contain the holder's name and contact information.

It is recommended that a running activity log be maintained, indicating the times of activities and observations; recorded data be written in the form of tables with an appropriate title; and that diagrams be included to illustrate pertinent information. Logbooks should be labeled with the project name, project number, and a consecutive number for cataloging purposes.

Copies made for the project file will become the primary record of the job activities. The filled logbook remains a working copy until project completion, at which time the logbook is physically stored in the project files.

6.0 REFERENCES

Environmental Research Center, University of Nevada - Las Vegas, March 1989, Soil Sampling Quality Assurance User's Guide: U.S. Environmental Protection Agency EPA/600/8-89/046, 260 p.

Fetter, C.W., 1994, Applied Hydrogeology: New York, Macmillan College Press Publishing Company, 691 p.

U.S. EPA, November 1992, RCRA Ground-Water Monitoring: Draft Technical Guidance: Office of Solid Waste and Emergency Response, OSWER-9950.1.

U.S. EPA, 1987, A Compendium of Superfund Field Operations Methods: Office of Solid Waste and Emergency Response, OSWER 9355.0-14.

U.S. EPA, 2005, Compliance-Focused Environmental Management System – Enforcement Agreement Guidance: National Enforcement Investigations Center, EPA-330/9-97-002R. http://www.epa.gov/oecaerth/resources/policies/neic/cfems_05.pdf.

U.S. EPA, 2007, Contract Laboratory Program Guidance for Field Samplers: Office of Superfund Remediation and Technology Innovation, OSWER 9240.0-44, EPA 540-R-17-06. http://www.epa.gov/superfund/programs/clp/download/sampler/clp_sampler_guidance.pdf.

U.S. EPA, 1988, Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA: Office of Solid Waste and Emergency Response, OSWER 9355.3-01. <http://www.epa.gov/superfund/policy/remedy/pdfs/540g-89004-s.pdf>.

U.S. EPA, 1991, Guidance for Performing Preliminary Assessments Under CERCLA: Office of Solid Waste and Emergency Response, OSWER 9345.0-01A.

<http://www.epa.gov/superfund/sites/npl/hrsres/>.

U.S. EPA, 1991, Guidance for Performing Site Inspections Under CERCLA: Office of Solid Waste and Emergency Response, OSWER 9345.1-05. <http://www.epa.gov/superfund/sites/npl/hrsres/>.

22 - ENVIRONMENTAL SAMPLE PREPARATION

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) presents procedures for selecting appropriate sample containers and preservatives when collecting environmental samples for analysis at a selected laboratory. Procedures for packaging and shipping environmental samples are presented in KEY SOP 23 – *Sample Handling, Preservation, Packaging and Shipping*.

Environmental samples are those that are anticipated to be relatively low in analyte concentration. These samples consist of materials that may have been impacted by source area materials, but do not consist of source area materials such as sludge, material from drums, material from bulk storage tanks, *etc.* Examples of environmental samples include: soil samples collected adjacent to or underlying a source area, stream and sediment samples, and groundwater samples (which do not contain non-aqueous phase liquid).

1.1 Referenced SOPs

23 – Sample Handling, Preservation, Packaging and Shipping

1.2 Definitions

(Reserved)

2.0 REQUIRED MATERIALS

Required materials for sample containers and preservation may include:

- Laboratory-provided various sized glass containers (with Teflon[®]-lined lids or caps, clear or amber colored) as required for analysis
- Laboratory-provided various sized polyethylene containers (with Teflon[®]-lined lids or caps) as required for analysis
- Nitric acid
- Sulfuric acid
- Hydrochloric acid
- Sodium hydroxide
- Sodium thiosulfate
- Filtration equipment, if required

Project-specific, appropriate sample container size, sample volume, holding times, and preservatives should be presented in the Quality Assurance Project Plan (QAPP). The selected laboratory should be able to provide the most complete guidance on this topic, and will have been consulted during the preparation of the QAPP. This SOP is intended to provide general information to field and office personnel while preparing the project planning documents, ordering and shipping supplies, and performing sample collection activities.

3.0 METHODOLOGIES

3.1 Sample Containers

To limit potential chemical or physical changes in a sample during collection and transport, the sample container selection should be based on the following:

- Sample containers should be new and certified clean prior to sampling activities
- Sample containers should be constructed of non-reactive materials
- Sample containers should not chemically or physically alter the sample

The most widely used containers for aqueous samples are composed of glass or polyethylene.

3.2 Aqueous Samples

Glass Containers

Glass containers will be used when organic compounds are the analytes of interest. Sample volume will be sufficient to fill each sample container to allow the laboratory to attain the method-specific detection limits. Specific to volatile organic analysis, sample volume will be sufficient to fill each sample container so that no air bubbles are present. Once the sample container is full and preserved, if appropriate, it will be sealed with a Teflon[®]-lined screw cap. Specific container sizes for each analytical category are presented in the project-specific QAPP.

Polyethylene Containers

Polyethylene containers will be used for aqueous samples when metals and/or inorganic analytes are the parameters of interest. One-liter polyethylene bottles with solid polyethylene or polyethylene-lined caps will generally be used to collect groundwater samples for metals and inorganic analysis. Once the sample container is full and preserved, if appropriate, it will be sealed with the polyethylene screw cap. Specific container sizes for each analytical category are presented in the project-specific QAPP.

3.2 Solid Samples

Sample containers for the soil matrix are typically clear glass with a volume of 8 ounces. Larger sample containers may be necessary depending upon the number and type of analyses.

3.3 Sample Preservation

Sample preservation is important to retard physical and chemical alterations of unstable analytes within the sample matrix. Sample preservation methods are limited and are generally intended to:

- Retard biological action
- Retard hydrolysis of chemical compounds and complexes

- Limit photolysis
- Reduce volatility of constituents
- Reduce sorption effects

Preservation is usually limited to acidification, treatment with an alkaline chemical, reducing light exposure, filtration, and refrigeration.

Prior to any form of preservation, the following parameters, at a minimum, will be measured in the field on water samples and recorded in the field notebook:

- pH
- Specific conductance
- Temperature

These field measurements record baseline information on the water sample prior to external influences such as temperature, dissolved carbon dioxide, or oxygen affecting the sample.

Acidification

Acidification of samples is generally performed for two purposes. Acidifying a (water) sample serves to limit metal adsorption to the sample container and will maintain the metal in a dissolved state. Secondly, acidification will act to inhibit bacterial growth. Samples to be acidified for either purpose will require a minimum volume of 100 ml and will be acidified to a $\text{pH} < 2$. Acidification is performed immediately after taking field measurements or following sample filtration.

Alkaline Treatment

Samples are preserved with an alkaline chemical (*e.g.* NaOH) to form salts with volatile compounds such as cyanide. Samples undergoing this preservation require a minimum volume of 100 ml and will be treated to a $\text{pH} > 12$.

Preservation of the sample will be performed by the addition of NaOH until the desired pH is achieved ($\text{pH} > 12$). Preservation of a water sample is performed immediately after the field measurements are collected and recorded.

Filtration

Filtration of samples will be used only for specific analytical parameters. It will be used when the dissolved metal content of water is of concern. Filtration will not be performed for samples to be analyzed for volatile organics, semi-volatile organics, or total recoverable metals.

When sample filtration is required, the sample will be drawn through a 0.45 micron filter. The filter material will either be paper or fiberglass dependent on the nature of the sampled water. Filtration is performed immediately following the field measurements and prior to any other

preservation methods. If the sample contains a significant level of suspended solids, a paper prefilter will be used prior to the 0.45 micron filter.

Temperature Control

All field samples that are to be analyzed by the laboratory will be sealed and then refrigerated during transfer to and storage at the laboratory. Refrigeration of samples is a bacterial inhibitor and slows the chemical and biological changes of a sample exposed to an oxidizing atmosphere. Transfer and storage of samples will be between 0°C and 10°C, with a target temperature of 4°C. Solid samples are typically limited to this preservation method.

3.4 Laboratory Selection and Coordination

Choosing a qualified analytical laboratory is an integral part of sampling activities. Regulatory program requirements and certifications must be considered in selecting the laboratory to ensure that the laboratory is capable of meeting project-specific requirements. Also, the provisions of any Consent Orders or Unilateral Orders applicable to the project must be reviewed and communicated to the laboratory to ensure project-specific requirements are met.

Laboratory Selection

An analytical laboratory will be chosen based on the following criteria:

- Capabilities of the laboratory including performance history, certifications, and regulatory program experience
- The qualifications and experience of the laboratory staff
- Availability of a designated technical client representative who serves as a single point of contact for all KEY projects
- Quality and completeness of standard deliverables, including electronic data transfer availability
- The specified analyses and turnaround time
- The adequacy of the laboratory's quality assurance/quality control program

Coordination

After selecting a laboratory, the laboratory will be contacted and the following information requested pertaining to the sampling activities:

- Identification of a responsible party to act as sample custodian at the laboratory who is authorized to accept samples and verify the data entered from the accompanying chain-of-custody forms into the laboratory tracking system
- Provisions for a laboratory sample custody log consisting of serially numbered, standard laboratory tracking report sheets
- Specifications of laboratory sample custody procedures for sample handling, storage, and disbursement for analysis

The laboratory will be notified within 48 hours prior to receipt of samples. The samples will be packaged and shipped *via* express courier or hand delivered within 48 hours of collection to the laboratory. The laboratory will then be contacted to verify receipt of the samples and estimated turnaround time.

3.5 Sample Packaging and Shipping

Proper sample packaging and shipping accomplishes the following:

- Allows individual samples to be tracked through transport and analysis
- Limits the possibility of breaking or losing a sample bottle during transport
- Is part of formal chain-of-custody (COC) procedures (tracking of possession of the samples)

Samples will be packaged and shipped according to the procedures in *SOP 23 – Sample Handling, Preservation, Packaging and Shipping*.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

(Reserved)

5.0 DATA RECORDING OR MANAGEMENT

(Reserved)

6.0 REFERENCES

U.S. Environmental Protection Agency, 1986, RCRA Groundwater Monitoring Technical Enforcement Guidance Document: Washington, D.C., OSWER-9950.1.

U.S. Environmental Protection Agency, 1986, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods - SW-846 3rd Edition (with revisions): Washington, D.C.

U.S. Environmental Protection Agency, 1987, A Compendium of Superfund Field Operations Methods, Part 1: Washington, D.C., EPA/540/P-87/001.

U.S. Environmental Protection Agency, 1991, Compendium of ERT Groundwater Sampling Procedures: Washington, D.C., EPA/540/P-91/007.

23 - SAMPLE HANDLING, PRESERVATION, PACKAGING AND SHIPPING

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) describes the procedures associated with the handling, preservation, packaging, and shipment of environmental samples for laboratory analysis or testing. Environmental samples may consist of air, groundwater, surface water, sediments or soil. The objective of sample preparation, handling, packaging, and shipping protocols is to develop standard procedures which will preserve the integrity of the samples and minimize the potential for sample tracking errors, sample spillage or leakage, and/or sample container breakage. The field team leader is responsible for the implementation of the sample handling, preservation, packaging, and shipping requirements outlined in the project-specific sampling and analysis plan (SAP).

1.1 Referenced SOPs

24 – Chain of Custody

1.2 Definitions

(Reserved)

2.0 REQUIRED MATERIALS

Required materials may include the following:

- Sample containers (preserved, as necessary, provided by the laboratory)
- Sample bottle labels
- Chain-of-Custody forms
- Sample cooler
- Bubble wrap or other suitable packing material
- “Blue Ice” (*i.e.*, reusable, freezable ice packs) or sealed bagged ice
- Shipping bills (Federal Express, UPS, etc.)
- Field Logbook
- Indelible ink pens
- Packaging tape
- Zip-lock type plastic bags

3.0 METHODOLOGIES

3.1 Sample Handling

Sample Containers

Sample containers and appropriate preservatives (where necessary) will be supplied by the analytical laboratory. After the respective sample containers have been filled with appropriate sample media and preserved as necessary, samples will be properly identified using sample container labels, and the samples will be stored at an appropriate temperature (usually $<4^{\circ}\text{C}$) to preserve the integrity of the samples.

Sample Preservation

Preservatives will be supplied by the laboratory. When possible, preserved containers should be supplied by the lab. Common preservatives include hydrochloric acid (HCl), sulfuric acid (H_2SO_4), nitric acid (HNO_3), or sodium hydroxide (NaOH). Samples will be preserved in accordance with EPA protocol specified in SW-846 or the project specific protocols outlined in the quality assurance project plan (QAPP). Use of the preservatives will be noted on the COC for each particular sample and analytical parameter.

Sample Labels

Blank sample labels will be supplied by the analytical laboratory and affixed to the sample container. Sample labels will be completed using waterproof permanent markers or ink. The labels will be filled out at the time of sample collection by the field sampling personnel. The following identifying sample information will be included on the label:

- Client/Site
- Sample identification alpha-numeric code defined in the project planning documents
- Sample collector's initials
- Date and time (military) of sample collection
- Analytical method
- Laboratory analysis to be performed

Chain-of-Custody Forms

A chain-of-custody (COC) record will be established and maintained to document sample possession from the time of collection until receipt by the laboratory. A sample is considered to be in custody if it is in your physical possession, if it is in your view after being in possession, or if it is placed in a secure area with access controlled by you. Once samples are received by the laboratory, they will be handled under the laboratory internal COC procedures. Field sampling personnel will initiate a COC record by recording the following minimum data as the samples are collected:

- Client/Site
- Name(s) of sampler(s)
- Sample identification alpha-numeric code
- Date and time (military) of sample collection
- Type of sample (e.g., soil, groundwater)
- Number of containers per sample location
- Requested analyses
- Type of containers and preservatives used
- Name and address for the completed laboratory reports
- Name and address for the laboratory invoices
- Specific instructions/notes for the laboratory, as necessary

Sample COC forms will be placed in waterproof plastic bags and taped to the underside of the cooler lids. Sample COC forms will generally be supplied by the subcontracting analytical laboratory.

Subsequently, at each change of possession, the COC record will be signed by the person relinquishing the samples and by the person receiving the samples. The date and time of the transfer of possession of the sample will be recorded on the COC form; this occurs when the samples are transferred from the sampling personnel to the courier and when the samples are received at the analytical laboratory. Sample COC forms shall be completed in ink. Any transcription errors shall be corrected by striking the erroneous information with a single horizontal line. The correct information will be added immediately adjacent to the strikeout. The sampler should initial the correction. (Refer to *SOP 24 – Chain of Custody* for additional information).

3.2 Sample Packaging and Shipping

All samples will be transported to the analytical laboratory in durable, waterproof, secured metal or plastic coolers. Sample coolers will generally be supplied by the laboratory. All samples will be packaged very carefully to prevent sample breakage. Samples will be shipped *via* overnight carrier (e.g., Federal Express or United Parcel Service) or hand delivered to the analytical laboratory, generally within 48 hours of collection. Airbills serve as custody documentation during shipping. However, project specific protocols will be checked to assure that specified sample holding times are not exceeded in the event that samples are not shipped on the same day that they were collected. Additionally, the sample security and preservation must be maintained if samples are not to be transported immediately to the laboratory. The following procedure should be followed for packaging samples for shipment to the laboratory for testing and/or analysis.

1. Place plastic bubble wrap matting or suitable material over the base and bottom corners of each cooler or shipping container.
2. Obtain a chain-of-custody record (similar to the example shown in Attachment 1 of *SOP 24 – Chain of Custody*) and enter all the appropriate information as discussed above. Chain-of-custody records will include complete information for each sample. One or more chain-of-custody records shall be completed for each cooler or shipping container as needed to manifest each sample.

3. Place bubble wrapping or other suitable material around glass bottles and place standing upright on the base of the cooler, taking care to leave room for packing material and ice or equivalent. Rubber bands or tape may be used to secure wrapping completely around each sample bottle.
4. Place additional bubble wrap and/or Styrofoam pellet packing or equivalent material throughout the voids between sample containers within each cooler.
5. Place cold packs or ice in heavy duty zip-lock type plastic bags, completely close the bags, and distribute such packages over the top of the samples. Add additional bubble wrap and/or Styrofoam pellets or other packing materials to fill the balance of the cooler or container.
6. If shipping the samples by express, courier, or delivery service, sign the chain-of-custody record thereby relinquishing custody of the samples. The date and time of custody transfer should be recorded on the chain-of-custody form. The custody transfer should be documented when directly transferring custody to a receiving party or when transmitting to a shipping service for subsequent receipt by the analytical laboratory. The shipping service should not be asked to sign chain-of-custody records.
7. Remove the last copy from the chain-of-custody record and retain with the field records. Place the original and remaining copies in a zip-lock type plastic bag and tape the bag to the underside of the lid of the cooler or shipping container.
8. Close the top or lid of the cooler or shipping container and with another person gently rotate the container to verify that the contents are packed so that they do not move. Improve the packaging if needed and reclose.
9. Packaging tape should be wrapped entirely around the sample shipping containers. A minimum of two full wraps of packaging tape will be placed in at least two places on the cooler or shipping container. Some project-specific QAPP may require custody seals be placed on the sample shipping containers. Sign and date the chain-of-custody tape.
- 10a. When transporting samples by automobile to the laboratory, and where periodic changes of ice are required, the cooler should only be temporarily closed so that reopening of the cooler can be easily performed. In these cases, chain-of-custody will be maintained by the person transporting the samples and chain-of-custody tape need not be used. If the cooler is to be left unattended, then chain-of-custody procedures should be implemented.
- 10b. If shipment is required, transport the cooler to an overnight express package terminal or arrange for pickup. Obtain copies of all shipment records as provided by the shipping service.
11. Upon receipt of the samples, the analytical laboratory will open the cooler or shipping container and will sign "received by laboratory" on each chain-of-custody form. The

laboratory will verify that the chain-of-custody tape has not been broken previously and that the chain-of-custody tape number corresponds with the number on the chain-of-custody record. The analytical laboratory will then forward the back copy of the chain-of-custody record to the sample collector to indicate that sample transmittal is complete.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

Prior to the samples leaving the site, each sample number and analyses, etc. are to be checked against the project planning documents, sample log sheets/field logbook, and chain of custody forms to ensure that all required samples have been collected and are labeled appropriately, and that bottles are filled for all required analyses.

Quality control samples such as rinsate blanks and duplicates will be specified by the project QAPP. A sample jar containing water should be sent as a temperature blank with each sample shipment requiring temperature preservation to ensure proper temperature is maintained. Also, a trip blank, provided by the laboratory will accompany shipments with samples intended for volatile organic chemical (VOC) analysis.

5.0 DOCUMENTATION AND RECORD KEEPING

The documentation for supporting the sample handling, preservation, packaging and shipping will consist of chain-of-custody records, shipping records and laboratory reports. In addition, a description of sample packaging procedures will be written in the Field Log Book. All documentation will be retained both physically and electronically in the project files.

6.0 REFERENCES

U.S. Environmental Protection Agency, 1986, RCRA Groundwater Monitoring Technical Enforcement Guidance Document: Washington, D.C., OSWER-9950.1.

U.S. Environmental Protection Agency, 1986, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods - SW-846 3rd Edition (with revisions): Washington, D.C.

U.S. Environmental Protection Agency, 1987, A Compendium of Superfund Field Operations Methods, Part 1: Washington, D.C., EPA/540/P-87/001.

U.S. Environmental Protection Agency, 1991, Compendium of ERT Groundwater Sampling Procedures: Washington, D.C., EPA/540/P-91/007.

24 - CHAIN OF CUSTODY

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) presents procedures for documenting possession/custody of environmental samples from the time of collection through delivery to the receiving analytical laboratory. At this point, internal laboratory records should document sample custody until final disposition. This SOP also discusses sample identification and the use of chain-of-custody (COC) forms.

Possession of a sample must be traceable from the time it is collected until analysis is completed. To document sample possession, chain-of-custody procedures are followed. Chain-of-custody evidence includes all documentation associated with the sample including the chain-of-custody form, sample label, custody seal, courier's receipt (if applicable), and field notebook.

A sample is under custody if one or more of the following criteria are met:

- It is in possession of the custodian or a designated member of the sampling team
- It is in plain view, after being in possession
- It was in possession and is secured against tampering
- It is placed in a designated secure area.

1.1 Referenced SOPs

23- Sample Handling, Preservation, Packaging and Shipping

1.2 Definitions

(Reserved)

2.0 REQUIRED MATERIALS

- Sample containers
- Sample container labels
- Chain-of-custody forms
- Zip-lock type plastic bags and tape
- Field logbook and permanent ink, waterproof pen
- Shipping airbills
- Shipping containers
- Locks or packaging tape
- Custody seals.

3.0 METHODOLOGIES

The Project Manager (or designee) is responsible for ensuring that sample labeling is completed in accordance with this SOP and that chain-of-custody forms are completed for sample shipments. All individuals relinquishing and receiving samples shall sign, date, and record the time on the chain-of-custody forms.

3.1 Sample Identification

Blank sample labels will be supplied by the analytical laboratory and affixed to the sample container. Sample labels will be completed using waterproof permanent markers or ink. The labels will be filled out at the time of sample collection by the field sampling personnel. The following identifying sample information will be included on the label:

- Client/Site
- Unique sample identification alpha-numeric code as specified in the Sampling and Analysis Plan
- Sample collector's initials
- Date and time (military) of sample collection
- Analytical method
- Laboratory analysis to be performed

3.2 Chain-of-Custody Forms

Once the sample containers have been filled with the sampled media and properly labeled, they will be prepared for shipment to the receiving analytical laboratory. Coolers containing samples will be accompanied by a chain-of-custody form (see example COC form in Attachment 1).

The field team leader (or designee) shall complete a chain-of-custody form for each lot of packaged samples (*e.g.*, each cooler). COC forms shall be completed in ink. Any transcription errors shall be corrected by striking the erroneous information with a single horizontal line. The corrected information shall be added immediately adjacent to the strikeout. The sampler should initial the correction.

The following information will be recorded on the COC form:

- Client/Site
- Name(s) of sampler(s)
- Sample identification alpha-numeric code
- Date and time (military) of sample collection
- Type of sample (*e.g.*, soil, groundwater)
- Number of containers per sample location
- Requested analyses
- Type of preservatives used

- Name and address for the completed laboratory reports
- Name and address for laboratory invoices
- Specific instructions/notes for the laboratory, as necessary

Any area of the COC, where sample information is not completed should have a diagonal line initialed by the sampler to show that this portion of the COC will not be completed.

Each COC will be placed in a waterproof zip lock plastic bag and affixed to the underside of the shipping container lid. Samples will be packaged properly for shipment as described in *SOP 23 – Sample Handling, Preservation, Packaging and Shipping*, and dispatched to the appropriate laboratory for analysis. Shipping containers will be padlocked or otherwise sealed for shipment to the laboratory, including the placement of custody seals that would indicate a container has been tampered with.

All shipments should be accompanied by the completed Chain-of-Custody Record. The original record will accompany the shipment to the laboratory, and a copy will be retained by the field team leader for the project file. Shipping bills and receipts must be retained as part of the chain-of-custody documentation. These documents should be scanned weekly and will become part of the permanent project files. Paper copies will be maintained in the project files in the office.

Upon receipt of the samples by the laboratory, the laboratory person assigned to log-in samples will confirm that the shipping container seals are in good condition and have not been disturbed. If a disturbance is noted, the laboratory shall notify the Key Project Manager at once. The original chain-of-custody form is to be signed and dated by the laboratory person logging in the samples. In addition, the receiving laboratory is to inspect each sample and indicate the condition of the sample on the COC. The receiving laboratory is to retain a copy of each chain-of-custody form along with the shipping bill. Internal laboratory chain-of-custody procedures will be followed once samples are logged in by the receiving laboratory.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

Prior to shipment, the Field Supervisor shall check to ensure that sample numbers are correct, sample paperwork is complete, field logbooks are maintained, and that the Sampling and Analysis Plan has been followed. If a particular sample location is inaccessible or if a sample could not be collected for any reason, the Project Manager is to be notified immediately. Such information must be included in the field logbook.

5.0 DATA RECORDING/MANAGEMENT

All sampling activities are to be documented in the field logbook. As discussed in Section 3.0, information related to tracking environmental samples will be recorded on the COC forms which will be retained in the project files.

All pages of the field logbooks relevant to sampling, as well as copies of all paperwork (COC forms, shipping labels, etc.) are to be scanned. Both paper copies and the digital copies become part of the permanent project file.

6.0 REFERENCES

U.S. Environmental Protection Agency, 1986, RCRA Ground-Water Monitoring Technical Enforcement Guidance Document: Office of Waste Programs Enforcement, Washington, D.C., EPA/530/Sw-86/055.

U.S. Environmental Protection Agency, 1986, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846 3rd Edition (with revisions): Washington, D.C.

U.S. Environmental Protection Agency, 1987, A Compendium of Superfund Field Operations Methods, Part 1: Washington, D.C., EPA/540/P-87/001.

U.S. Environmental Protection Agency, 1991, Compendium of ERT Groundwater Sampling Procedures: Washington, D.C., EPA/540/P-91/007.

[illegible]

Distribution: Original to Accompany samples; Copy Returned with Report

C:\Users\sal\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\BG80X3WA\COC form
Revised 8/13/2012
Form #:

*Quality Assurance Project Plan
South Cavalcade Superfund Site
Houston, Texas*

*Section: Appendix B
Revision: 2
Date: May 2013*

APPENDIX B
LABORATORY QUALITY MANUAL
(LATER)